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Crease-Resisting Fabrics

By CHESTER AMICK*

THE desire to manufacture cellulosic fabrics which have crease-resisting properties is old. Cotton mill men have long envied their brethren who were in the silk, wool, and worsted business because these latter fabrics tend to hold their shape and stay reasonably free from creases. The manufacturers of heavy cotton fabrics which were to be used for men's trousers have long appreciated the inferior qualities of their product when compared to tropical worsteds, particularly as regards the tendency of the cotton trousers to bag at the knees. However, no simple way was found to overcome this defect and men who wore cotton trousers had to put up with it. Of course, it is understood that the designers of men's suitings appreciated this defect and they did accomplish a lot when they brought out cotton seersuckers, but one would hardly wear a seersucker suit to all the places where a tropical worsted or a flannel would be proper. So the men were the first to suffer as a result of the lack of resilience of cellulosic materials.

With the advent of rayon, it was soon noticed that fabrics made therefrom wrinkled or creased much worse than a similar construction made from cotton. Inasmuch as rayon was then considered to be a competitor of real silk, this tendency to muss easily was a serious matter and caused unusual attention to be focused on the whole subject, not only for rayons but upon cottons as well, particularly sheers.

It is possible to launder a piece of real silk, hang it up to dry and subsequently wear it without ironing, particularly if it is an under-garment. While it is possible to do the same thing with a cotton garment, it just is not done. The latter garment will not air-dry as wrinkle-free as the silk garment and therein lies the difference. However, it is a triumph for the rayon manufacturers that they have been able to overcome much of the difficulty which their product presented originally. This has been accomplished by intelligent research and skillful control of plant operations.

A real drive to improve cotton and rayon as regards their tendency to crease, got under way in England after the war. It was soon found that creasing and elasticity were opposites. An inelastic fabric composed of cotton or linen yarns creased very badly. An elastic fabric composed of silk or woolen yarns did not crease so badly. A second factor, elastic after-effect (Elastisches Nachwirchung) is also important, perhaps more important than the elasticity itself as will be shown further along. A rubber band is elastic in that it returns practically to normal when it is released after stretching. A woolen fiber if given a short sharp stress returns to about 50-60 per cent† when the stress is removed. This is the elasticity factor. If the fiber is allowed to rest for a month, it will finally assume its original length, or very nearly so. This recovery during the rest period is the elastic after-effect. A fabric to be used for dress materials must also have plasticity to permit that coveted effect, drapiness. But plasticity is opposed to elasticity and may be to elastic after-effect. So it is necessary to maintain a proper balance between these properties for the ideal dress material which will have clinging power and still not crease too badly.

It is rather interesting to consider the possibility of forecasting the properties of fabrics which will have crease-resisting qualities. To get a better crease-resistance it is necessary to improve the elasticity and the elastic after-effect, so if the plasticity remains constant, it can be prophesied that the resulting fabric will have less draping quality, will be somewhat more wiry, and will be less sleazy. If the increase in the elastic properties upsets the balance too greatly, the structure of the fabric or of the yarns must be altered, to retain the proper equilibrium.

Before proceeding further, it seems worth while to point out another guiding post that was observed in the development of the crease-resisting process. At one stage of the process it was decided to apply something to the fiber. The question was whether to coat the fiber on the outside,

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† From research report of the author (1929).

or to squeeze something into the innermost parts of the cotton hair of which there are about 80 million per pound. This problem was answered by considering the heavy duty rubber-hose pipe. This is usually reinforced by steel wires. If the wire is wound spirally on the outside of the rubber, the resulting pipe is stiff and awkward. However, if the wire is imbedded in the rubber, the resulting stiffness is not nearly so great, yet the reinforcement is just as good or practically so.

So it could be determined in advance that a proper balance between the physical properties of the fabric had to be maintained, that a fabric which was less susceptible to creasing would be more elastic, more wiry and less sleazy. Furthermore, the elasticity would be increased if the fiber were filled with some material which could be made insoluble after it had been placed inside the fiber or around the outside and finally, the wiryness would be less if this material were located inside of the hairs instead of on the outside. With these guideposts, the problem of securing crease-resisting fabrics was tremendously simplified. Hastily, it should be added that the problem was not simple even with these sign posts pointing the way. It is important to remember that of all the materials tried, the synthetic resins seem to be by far the most satisfactory. And of the synthetic resins which will work, the one which had the least commercial importance at the moment, perhaps, was the one which proved most satisfactory. This is the urea-formaldehyde type of resin and, of course, the urea can be substituted by its homologues.

UREA-FORMALDEHYDE RESINS

Historical

The application of urea-formaldehyde resins to textile fabrics to secure a permanent finish (either crease-resisting, back-filling or stiffening) promises such a bright future that it will be profitable to develop the history of the production of the resins themselves. The first U. S. Patent in this field was granted to Hanns John (U. S. P. 1,355,834, Oct. 19, 1920).

"Be it known that I, Hanns John, magister of pharmacy, a citizen of the Czechoslovakian Republic, residing at Prague, Manesgasse, Czechoslovakia, have invented certain new and useful improvements in manufacture of aldehyde condensation products capable of technical utilization, of which the following is a specification.

"My invention relates to the manufacture of products obtained by condensation of an aliphatic aldehyde, preferably of formic aldehyde, with carbamid (urea) or thiocarbamid or other carbamid derivatives, they being substantially equivalent.

"The action of formic aldehyde on urea has been studied by various chemists. C. Goldschmidt, for instance, has caused formic aldehyde to act upon urea in the presence of potassium hydroxid. By this reaction, he obtained an amorphous substance which readily disengaged formic aldehyde and which he assumed to be dimethylolcarbamid.

"All the products obtained up to the present by condensation of formic aldehyde with carbamid, were of no technical value or could not be used for industrial purposes, owing to their physical and chemical properties.

"Now I have found that by carrying out the reaction between formic aldehyde and carbamid or its derivatives in a special manner, it is possible to produce different substances for a variety of technical applications.

"By causing the condensation to take place either in the presence of alkali or other condensing mediums or making the starting substances to react upon each other at a low temperature during a more or less long time, the prior authors only obtained products such as the above mentioned dimethylolcarbamid, whereas by the process according to my invention substances are produced which were up to now unknown, and which are quite distinct from dimethylolcarbamid.

"I have found that, in order to obtain condensation products fit for industrial applications, the reaction is to be carried out without addition of condensing agents and at a higher temperature. According to the quantities of formic aldehyde and of carbamid present, as well as according to the duration and height of heating applied, products of very different nature are obtained.

"If the ingredients are caused to react only during a comparatively short period, the product of condensation is still soluble in water. This solution is highly adhesive and, when dried, leaves the condensation product in the shape of a perfectly colorless product which is transparent like glass and insoluble in all inert solvents. In this stage, therefore, a glue is produced which sticks in a cold state to all objects, of preference with smooth surfaces such as glass, metals, etc. The substance may also, besides other applications, be used for filling root-canals in dental surgery, or as a lacquer which can be laid directly on without addition of spirituous or such like solvents. This colorless and brilliant lacquer may be mixed with any organic or mineral pigments. Furthermore, it may advantageously be utilized for impregnating materials or fabrics of any kind, especially for covering the supporting planes of flying machines, and such like.

"If from the beginning, the ingredients are brought together on such conditions that the process will be achieved only in a longer time than stated above, the resultant product of condensation will be still fluid in a heated state, but it will gelatinize when being cooled. In this way prepared, the product forms a colorless, transparent, tensile and elastic mass, insoluble in water as well as in alcoholic solvents, and which is acted upon only by acids or alkaline liquors. This mass can be used as a substitute for indiarubber or such like.

"The substance produced in the manner described, is moreover capable of being hardened. This hardening process is carried out most advantageously by heating the product up to say 80° C. According to the duration of the hardening process, the final products show different properties. The main advantage is that also the hardened product is colorless and transparent, as well as rather re-

sistant to chemical agents, that it is readily to be worked and possesses a sufficient degree of elasticity.

"When strongly heated, the substance is carbonized but does not flare up.

"Five parts of a commercial solution (say 40 per cent) formic aldehyde (formaldehyde) and one part carbamid (urea) are heated in a distilling vessel or still. When an *adequate* (italics mine) proportion of the liquid is distilled off, the glue-like mass as described above is obtained.

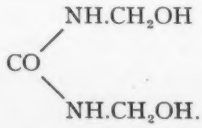
"Six parts of a commercial solution of formic aldehyde and one part of carbamid are heated in a distilling vessel until nearly *half* the liquid has been distilled off. After cooling, the gelatinous product described above, is obtained.

"The different products as described may be used, according to their special properties, as a glue, lacquer, impregnating material, or as a substitute for rubber, ebonite, celluloid, horn or for other industrial purposes."

John has 10 claims, eight of which cover the process of manufacturing the new product and two for the product itself. John deliberately refrained from adding any catalyst, probably because of the prior work of Goldschmidt which work might have made it more difficult to secure a patent and also because John thought that his product was superior to that obtained by Goldschmidt. Furthermore, John carried out his reaction at a higher temperature than that used by Goldschmidt. Apparently, John overlooked the fact that commercial formaldehyde usually contains a variable amount of formic acid and that his solutions must have shown an acid reaction. True, urea is basic and would tend to react with the formic acid to neutralize it. But the dissociation constant of formic acid is 2.14×10^{-4} at 25° C., while the dissociation constant of urea is 1.5×10^{-14} at the same temperature.

Three years later, Fritz Pollak secured a patent in the U. S. (No. 1,458,543, dated June 12, 1923) for the "manufacture of condensation products from urea on the one hand and formaldehyde on the other hand which, as contradistinguished from other reaction products of this kind are found to be useful in many arts." Pollak was able to secure his patent because he *used* a catalyst in preparing his resin.

It is not a simple matter to make synthetic resins from urea and formaldehyde but let Pollak tell the story: "The reaction between urea (carbamide) and formaldehyde leads (according to the conditions selected) to very different results. Thus Goldschmidt (Berliner Berichte *29*, 2438) has found that when a solution of urea in hydrochloric acid is caused to act on formaldehyde in excess in the cold, a product is obtained which is insoluble in most solvents. In the German Patent, No. 97,164, he states that by the action of urea on formaldehyde in the proportion by weight of 1-5 (1 mole of urea to four moles of formaldehyde) in alkaline solution and in the cold, dimethylol of urea is obtained.



This is denied by Einhorn and Hamburger (Berichte *41*, 24) who obtain dimethylol or urea from one molecule of urea and two moles of formaldehyde in the presence of a little hydroxide of barium at 25-30° C. In a similar manner monomethylol of urea is obtained by the action of urea in excess and in the presence of a very small quantity of hydroxide of barium on formaldehyde when cooling with ice. At last it has been proposed (in U. S. Patent No. 1,355,834—John) to carry out the reaction in the absence of condensing agents and while heating for obtaining condensation products which are believed to be different from di-methylol of urea.

"Now I have found that by means of this reaction condensation products fit for use in industry can only be obtained if just in presence of basic condensation agents the reaction of formaldehyde on carbamide or thio carbamide or their derivatives is brought about by heating and if the heating is continued up to the formation of easily gelatinizing products, which in the further course of the heating are hardening to form a glass-like mass. During this reaction most likely dimethylol carbamide is formed as an intermediate product. In any case, if the process is started with dimethylol carbamide instead of the mixture of formaldehyde and urea, exactly the same intermediate and final products can be obtained. Urea itself may be used as a condensing agent, this compound too being a weak base, although this is not a particularly advantageous mode of carrying into practice the present process. But it has been found that ammonia is a very suitable condensing agent in connection with this reaction and ammonia may be added beforehand in the form of hexamethylene tetramine which is formed in any case from ammonia and formaldehyde. Pyridine, for instance, is also a suitable condensing agent in certain cases. Whatever base may be used as a condensing agent, it undoubtedly results in considerable acceleration of the reaction.

"The final product obtainable by the present process of the reaction between urea and formaldehyde is a limpid, transparent, uncolored mass insoluble in acids and alkalies which is particularly distinguished by its indifference to acids, even to nitric acid. This mass is entirely different from those heretofore obtained by its other properties also, in as much as it does not soften on being heated and is notably harder and stronger.

"Its specific gravity is 1.3 and it is carbonized only at temperatures above 300° C., its hardness is approximately that of the entirely hardened condensation products of phenols and formaldehyde, its fracture is conchoidal and it may be very easily sawed, turned, bored, filed and polished and it has a high luster.

"The initial products of the chemical condensation are uncolored, transparent, limpid liquids readily soluble in water. By heating these initial products for a short time they are at first converted into another condensation product which is intermediate in character between the initial and the final products above described and which is hereinafter referred to as the intermediate condensation prod-

uct. These latter are soluble in commercial formaldehyde but insoluble in water and may be precipitated from their solutions in formaldehyde in a gelatinous form by means of water. They swell with water, do not fuse together when heated, but after removal of the water contained in the same they fairly closely resemble soft rubber. For convenience I will hereinafter refer to both the initial and intermediate condensation products as 'partial reaction products' in contradistinction to the insoluble and infusible mass which constitutes the final condensation product.

"For carrying out the reaction in the heat heretofore formaldehyde had been used in large excess. It has now been found that it is advantageous to avoid as far as possible the presence of free formaldehyde on converting the initial condensation products into the intermediate and final ones. Preferably the use of any excess of formaldehyde is avoided beforehand, that is to say, in making the soluble initial condensation product, or at any rate a smaller excess of formaldehyde is made use of than corresponds to 3 moles of formaldehyde to 1 mole of urea, whereas heretofore much larger quantities of formaldehyde had been caused to enter into the reaction. Basic condensing agents have, however, preferably to be made use of in any case, whether formaldehyde is used in a proportion not exceeding 3 moles of the same to 1 molecule of urea, or whether a large excess of formaldehyde is used as heretofore; in this case any excess of formaldehyde has to be removed as far as possible before the initial condensation products are further treated.

"One hundred sixty-two parts by weight of commercial formaldehyde containing 40 per cent by volume of pure formaldehyde are mixed with 5 parts by weight of 20 per cent ammonia, to the mixture of formaldehyde and hexamethylene-tetramine thus formed 60 parts by weight of urea in a solid state are added. The urea is dissolved under considerable spontaneous cooling. When the urea is completely dissolved the solution is heated in a boiler with a reflux condenser which brings about an exothermic reaction. Boiling is maintained only until the mass does not become turbid on cooling. Then the product of reaction is brought into a vacuum apparatus and distilled in the water bath until the residue has a syrupy consistency. Then the mass is filled into moulds and is heated to a temperature of 70-75° C. until it has converted into a hard fully transparent body of the properties above described. By dyeing and/or making the mass turbid in any suitable way, imitations of amber, ivory, jet, corals, tortoise-shell, horn, mother-of-pearl and so on may be obtained therefrom.

"As above mentioned the hardening of the initial reaction products may also take place in the presence of filling substances of any kind, for instance, the product may be mixed with loose pulverulent or fibrous and cellular materials such as wood-pulp, asbestos fibers, chalk, Plaster of Paris, carborundum, sand or the like, then brought into moulds and hardened either simultaneously or later. Or, porous substances such as wood, pasteboard or asbestos fabric may be impregnated with the initial reaction products or a solution of the same and then hardened, or the solution may be used for impregnating steam packings, piston rings or the like and may then be converted by the heat of the steam into the insoluble and hard form. These solutions may also be applied to an endless band of paper fabric or the like whereupon the solvent is permitted to evaporate and the band is wound on a heated drum in such a manner that the successive layers are cemented to each other and the mass is hardened whereby homogeneous round bodies are obtained. Or the intermediate condensation product—either alone or mixed with substances soluble or insoluble in the same—may be applied to any suitable backing and then hardened."

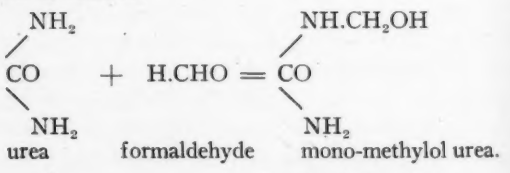
Pollak has 10 claims in his patent, five of them covering the process of making the synthetic resin using three moles of formaldehyde to one of urea, and three covering the process of making the synthetic resin using *less* than three moles of formaldehyde to one of urea. One claim covers the process of mixing the resin with a filling material before condensing to the insoluble stage and the last claim covers the product made by the second of the above processes.

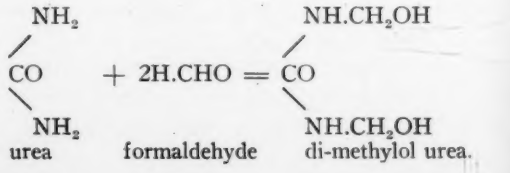
Six years later, Foulds, Marsh and Wood secured U. S. Patent 1,734,516 (Tootal Patent) for making crease-resisting fabrics and in this they included a third method of preparing synthetic urea-formaldehyde resins. "Urea (1 part by weight) and formaldehyde 40 per cent solution (2 parts) are mixed together and made slightly alkaline by the addition of hexamine or caustic soda. This mixture is refluxed at the boil for 3-5 minutes and cooled quickly. Three parts of this mixture are diluted with 1 part of water and one-half to three-quarters per cent of glacial acetic acid or the equivalent amount of any weak acid are added."

The foregoing process makes use of an alkaline solution for preparing what Pollak terms the initial condensation products and in this respect their method is similar to Pollak's. However, before application of this resin to fabrics, sufficient organic acid is added to throw the solution to the acid side, a point which neither John nor Pollak mentioned.

THEORETICAL DISCUSSION OF THE THREE METHODS

The primary reaction of formaldehyde and urea may be written as follows:





Both the mono- and di-methylol urea are water soluble forming true solutions from which they can be crystallized, and redissolved. The reaction is one of addition only and no water is given off. Consequently, no weight loss is encountered. This stage of the reaction is usually spoken of as the "A" stage.

Application of heat to the mono- and di-methylol urea solutions causes further reactions to set in. Two molecules of mono-methylol urea may combine with each other. two molecules of di-methylol urea may combine with each other or one of each may combine. Obviously, the final molecule is larger than the first which ever combination occurs, and as the reaction continues, the product passes from the true-solution state to the colloidal-solution state, or putting it another way, the resin forms a second phase and we have a colloidal solution, a suspension of resin in water. This is the "B" stage. If sufficient heat is applied, or a catalyst added to promote this combining of molecules, the entire volume will finally set up to a hard insoluble resin. This is the "C" stage.

The molecular weight of urea is roughly 60. The molecular weight of formaldehyde is roughly 30. If 30 parts of formaldehyde (one mole) react with 60 parts of urea (one mole) mono-methylol urea should be formed. Doubling the formaldehyde (two moles) should give di-methylol urea.

John in his patent specified either 5 or 6 parts of 40 per cent formaldehyde to 1 part of urea. Using 5 as the value, 40 per cent of that is two and so his ratio becomes—2 parts 100 per cent formaldehyde to 1 urea. Forty per cent of 6 gives 2.4. So John used enough formaldehyde to give di-methylol urea.

Pollak used 162 parts of formaldehyde (40 per cent solution) to which he added 1 part (100 per cent) ammonia. From the reactions

$$NH_3 + H_2O = NH_4OH \text{ and}$$
$$4NH_4OH + 6H.CHO = (CH_2)_6N_4 + 10H_2O$$

in which ammonia reacts with formaldehyde to give hexamethylene tetramine, it can readily be seen that ammonia combines with 6.6 parts of 40 per cent formaldehyde leaving approximately 155 parts to react with 60 parts of urea. Forty per cent of 155 gives 62 parts of 100 per cent formaldehyde or slightly over two moles ($62 \div 30 = 2^+$). So Pollak has used substantially the same ratio of formaldehyde to urea that John used, or enough to give di-methylol urea.

Foulds, Marsh and Wood used 1 part of urea to 2 parts 40 per cent formaldehyde (by weight). Multiplying each of the above figures by 30, we get 30 parts urea and 60 parts formaldehyde (40 per cent) or 30 parts urea and 24 parts formaldehyde (100 per cent). This is equal to 1 3/5 moles of formaldehyde to 1 of urea. Obviously, the Tootal process does not employ *all* di-methylol urea in the preparation of crease-resisting fabrics.

Zänker in 1933 secured a U. S. Patent 1,925,914 covering a "Process for Ennobling Cellulosic Materials and Product Therefrom" which in ordinary English means a "Process for Securing Crease-Resisting Fabrics." He uses 20 kilograms of urea and 50 kilograms of 40 per cent formaldehyde in his reaction mixture. This is exactly 2 moles of formaldehyde to 1 of urea and is essentially the same as the amounts used by John and Pollak. Zänker added ammonia until the urea-formaldehyde reaction mixture gave a "slight alkalinity," at the same time hexamethylene-tetramine was formed to serve as a catalyst. Zänker also added some aluminum acetate, the purpose of which will be discussed later.

Summing up, the following ratios of urea/formaldehyde reaction mixtures have been used in preparing synthetic resins:

John:	
2 moles H.CHO/1 urea.	No catalyst
2.4 moles H.CHO/1 urea.	
Pollak:	
2 to 3 moles H.CHO/1 urea.	Alkaline catalyst
Total	
1 3/5 moles H.CHO/1 urea.	Alkaline catalyst
Zänker:	
2 moles H.CHO/1 urea.	Alkaline catalyst

The first two do not specify any particular catalyst to be used in securing the final insoluble product; the last two specify an acid catalyst in securing the final insoluble product.

It is not in the scope of this paper to go into the details of resin manufacture and the subsequent effect on the properties of crease-resisting fabrics. It is worth mentioning, however, that as a result of having made many tons of this material and subsequently applying it to all kinds of fabrics, one of them in half million yard quantity, that certain things stand out as very important.

1. It is absolutely essential that the resin be in the truly soluble form when it is applied to the fabric, that is the "A" stage. Too great advancement toward the "B" stage will result in a stiff fabric which is not desirable or will result in the loss of resin during subsequent treatments to eliminate this stiffness which is expensive.
2. The more sharply the initial reactions can be stopped at the "A" stage, the better the keeping quality of the resin solution both before and after the acid catalyst has been added.
3. The heat control during the formation of the resin before applying it to the fabric is most important.
4. In applying color to fabric, you can *see* what is going on and act accordingly. In applying synthetic resins to fabrics, there is nothing to see and unless one has a lot of laboratory help, there is nothing to *feel* until several operations after the damage has been done.
5. The permanent character of the finish depends upon the thoroughness of the control.

(*To be continued*)

Principles of

Dyeing with Salt Dyes*

By L. R. PARKS and H. C. BEARD

SALT dyes have been defined by Parks and Beard[5] as *salts of organic color acids or bases which form true solutions in water, are removed as the salt by the fiber, and are dyed with the aid of neutral salts containing a common ion.*

Salts of monobasic organic color acids may be represented in general by the formula MR where M represents a univalent metallic cation and R the colored organic anion. Since salt dyes form true solutions in water the ionization of MR may be represented by

$$MR \rightleftarrows M^+ + R^-$$

Salts of univalent organic color bases may be represented by RA where R represents the univalent colored cation and A the acid anion. In aqueous solutions the ionization may be represented by

$$RA \rightleftarrows R^+ + A^-$$

It is the purpose of this paper to show, that dyeing with salt dyes is an adsorption phenomenon, that the salt dyes are removed as the salt by the fiber, that the effect of neutral salts with a common ion on the adsorption of salts or organic color acids is analogous to the effect of neutral salts with a common ion on the adsorption of inorganic bases, and, that the effect of neutral salts with a common ion on the adsorption of salts of organic color bases is analogous to the effect of neutral salts with a common ion on the adsorption of inorganic acids.

EXPERIMENTAL PROCEDURE

The procedures used in this investigation were the same as those of Parks and Bartlett[4]. All operations were under pH control by the use of the stick antimony electrode system[6, 7]. In the case of Methylene Blue, in order to reach air equilibrium, the flask was cooled in an atmosphere of CO_2-free air and then tumbled for one hour. The adsorbents were activated sugar charcoal, with an ash content of 0.14%, and unbleached, thoroughly washed wool, with an ash content of 0.26%. The wool was washed until the wash water maintained a constant pH ot 6.13. The salt dyes used were Metanil Yellow and Methylene Blue. These dyes were obtained in the pure salt state by repeated crystallization from a high grade of commercial "concentrate" dyestuffs. The inorganic salts used were of reagent grade.

The water used in all crystallizations and in the dyeing process was distilled from a Barnstead still and gave a pH value of 5.2 to 5.8. This is in agreement with the work of previous investigators[1, 2, 3] who have shown that pure distilled water in normal equilibrium with the CO_2 of the atmosphere has a pH value of 5.6 to 5.8 depending on the source of the water supply and atmospheric conditions.

The dyeing process was carried on by refluxing the adsorbent in the dye bath for 45 minutes. The volume of the dye bath was 250 cc., the weight of wool approximately 4.5 grams and the weight of charcoal 0.5 gram. All results were calculated for the amount of dyestuff adsorbed per gram of adsorbent. The wool was removed from the dye bath immediately at the end of the 45-minute period allowed for the dyeing process. The charcoal was filtered from the solution as soon as the time for dyeing elapsed. With charcoal as adsorbent, the dye bath was kept just under the boiling point so that the adsorbent was in a constant state of agitation but did not creep up onto the side of the container.

In order to determine the effect of electrolytes in the dye bath the amount of dye was kept constant in each solution and the amount of electrolytes added was varied. Each 250 cc. of solution contained a definite quantity of dye and varied volumes of 0.025 N inorganic salt. In the case of Metanil Yellow each 250 cc. of solution contained 50 milligrams of dyestuff. With Methylene Blue each 250 cc. of solution contained 40 milligrams of dye. The amount of dye left in the dye bath after adsorption was determined by titration with titanium chloride.

EXPERIMENTAL RESULTS

The subsequent tables and graph show that with increasing concentrations of pure salt dye in solution, whether Metanil Yellow or Methylene Blue, increasing amounts of dye are removed by both wool and charcoal.

TABLE I

Metanil Yellow Isothermal with Charcoal

Conc. dye mgs.	*pH before dyeing*	*pH after dyeing*	*Adsorbed per gm. Adsorbent x/m*	*Conc. dye left in solution C*
Water	5.60	6.18		
25	5.75	6.18	22.18 mgs.	2.82 mgs.
50	5.81	6.22	25.45	24.55
75	5.88	6.29	26.31	48.69
100	5.93	6.36	27.00	73.00
200	6.04	6.35	29.18	170.82
300	6.35	6.43	29.95	270.05

*Contributed from the Pond Chemical Laboratories of the Pennsylvania State College.

TABLE II

Metanil Yellow Isothermal with Wool

Conc. dye mgs.	*pH before dyeing*	*pH after dyeing*	*Adsorbed per gm. Adsorbent x/m*	*Conc. dye left in solution C*
Water	5.60	6.13		
25	5.75	6.10	1.45 mgs.	23.55 mgs.
50	5.81	6.20	2.72	47.28
75	5.88	6.27	3.85	71.15
100	5.93	6.32	5.13	94.87
150	5.99	6.41	6.80	143.20
200	6.04	6.48	7.27	192.73
250	6.25	6.82	7.95	242.05
300	6.35	6.97	8.24	291.76

TABLE III

Methylene Blue Isothermal with Wool

Conc. dye mgs.	*pH before dyeing*	*pH after dyeing*	*Adsorbed per gm. Adsorbent x/m*	*Conc. dye left in solution C*
Water	5.60	6.13		
10	4.75	5.46	0.87 mgs.	9.13 mgs.
20	4.73	5.50	1.92	18.08
50	3.87	4.40	4.83	45.17
100	2.89	3.57	8.29	91.71
150	2.49	2.91	9.86	140.14
200	2.28	2.46	10.44	189.56
300	2.21	2.21	11.45	288.55

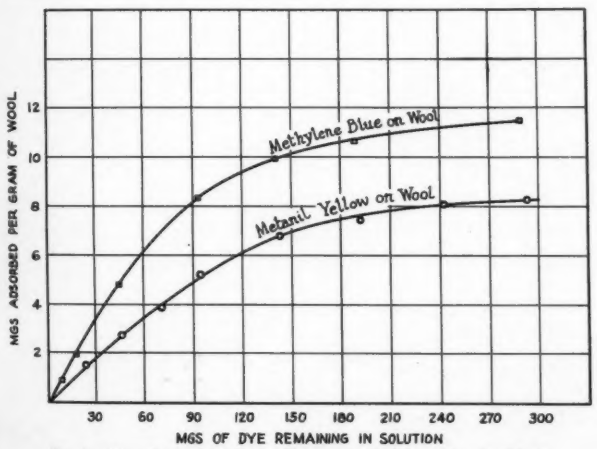


Fig. 1—Adsorption of Metanil Yellow and Methylene Blue by Wool.

The effect of varying concentration of electrolytes possessing a common ion with dyestuff, as sodium chloride and sodium sulfate, in the removal of dye from solutions of constant dye concentration is shown in the following tables.

TABLE IV

Adsorption of Metanil Yellow in the Presence of NaCl

(50 *mgs. of dye to* 250 *cc. of solution*)

cc. 0.025 N NaCl	*pH before dyeing*	*Wool as Adsorbent pH after dyeing*	*Wool as Adsorbent x/m mgs.*	*Charcoal as Adsorbent pH after dyeing*	*Charcoal as Adsorbent x/m mgs.*
0.0	5.81	6.20	2.72	6.22	22.54
5.0	5.85	6.21	2.88	6.18	25.23
10.0	5.85	6.19	3.07	6.09	26.69
20.0	5.77	6.23	3.32	6.11	27.47
30.0	5.76	6.11	3.50	6.16	27.78
40.0	5.78	6.17	3.58	6.09	28.39

TABLE V

Adsorption of Metanil Yellow in the Presence of Na_2SO_4

(50 *mgs. of dye to* 250 *cc. of solution*)

cc. 0.025 N Na_2SO_4	*pH before dyeing*	*Wool as Adsorbent pH after dyeing*	*Wool as Adsorbent x/m mgs.*	*Charcoal as Adsorbent pH after dyeing*	*Charcoal as Adsorbent x/m mgs.*
0.0	5.81	6.20	2.72	6.22	22.54
5.0	5.78	6.27	2.84	6.02	25.17
10.0	5.68	6.16	2.93	5.98	26.10
20.0	5.76	6.20	3.16	5.98	26.90
30.0	5.68	6.20	3.26	6.03	27.26
40.0	5.76	6.17	3.29	6.02	27.68

TABLE VI

Adsorption of Methylene Blue in the Presence of NaCl

(40 *mgs. of dye to* 250 *cc. of solution*)

cc. 0.025 N NaCl	*pH before dyeing*	*Wool as Adsorbent pH after dyeing*	*Wool as Adsorbent x/m mgs.*	*Charcoal as Adsorbent pH after dyeing*	*Charcoal as Adsorbent x/m mgs.*
0.0	4.06	4.75	4.28	3.84	42.69
5.0	4.06	4.76	4.36		
10.0	4.07	4.78	4.40		
20.0	4.06	4.76	4.44	4.25	44.32
30.0	4.06	4.76	4.45		
40.0	4.06	4.77	4.47	4.21	44.25

DISCUSSION

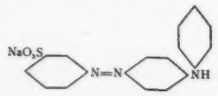
The graph shows clearly that Metanil Yellow and Methylene Blue are adsorbed by wool.

The pH values given in Tables I, II and III show a very gradual increase in pH with increased dye concentration in the case of Metanil Yellow while with Methylene Blue, under the same conditions, there is a marked decrease. These changes are due to the hydrolysis of the dye in aqueous solutions, Metanil Yellow hydrolyzing only slightly basic while Methylene Blue hydrolyzes strongly acid. The ratio of the increase in pH before and after dyeing is practically constant with all concentrations of the dye showing that the increase in pH is a property of the adsorbent and not a result of the dyeing process. In Tables IV, V and VI, which show the effect of varying concentrations of added salt to dye baths of constant dye concentration, the pH values in all cases denote that there is no change in pH proportional to increased salt concentration. This emphasizes the fact that dyeing with salt dyes is not due to hydrolytic adsorption. The pH values of the dye solutions before and after contact with the adsorbent demonstrate very conclusively that at no time is there any evidence of a chemical reaction between the wool fiber and the materials adsorbed.

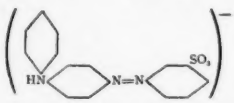
Since the process of dyeing with Salt Dyes is purely adsorption, then the addition to the dye bath of a neutral

inorganic salt, with an ion common to the dyestuff, should increase the amount of dye taken up by the adsorbent.

Salts of Organic Color Acids.—Metanil Yellow, the dye selected for this group, is a dye of the azo group with the formula



That it forms true aqueous solutions was verified by the ultramicroscope, dialysis, hydrolysis, and the determination of the boiling points. The dyestuff ionizes into Na^+ ions and



ions. For convenience in the discussion the anion will be denoted as RSO_3^-.

Examination of Table IV shows very clearly that there is an increase in the adsorption of the dye by both wool and charcoal, as adsorbents, with the addition of sodium chloride, a neutral salt with the common Na^+ ion. The mechanism of this increased adsorption may be explained as due to the increased quantity of Na^+ ions in solution.

The wool fiber contains spaces of all sizes and shapes between the chains of protein molecules, just as activated carbon contains spaces of all sizes and shapes between the carbon atoms. Some of these spaces are too small to hold one RSO_3^- ion, while others are large enough to hold one but not two, etc. If now some wool or activated carbon is placed in a solution of Metanil Yellow the RSO_3^- ions are more strongly absorbed than the sodium ions. The sodium ions tend to diffuse to portions of the solution where their concentration is not as great as at the surface of the wool or charcoal. Thus there is a tendency to pull the adsorbed RSO_3^- ions away from their attendant wool or charcoal particle. The adsorption of Metanil Yellow by wool or charcoal may be expressed by

$$\underline{[P]} + RSO_3Na \rightleftarrows \underline{[P]}\ RSO_3Na, \qquad (1)$$

where $\underline{[P]}$ represents a wool or charcoal particle regardless of size and RSO_3Na represents Metanil Yellow. The ionization of $\underline{[P]}\ RSO_3Na$ may be represented by

$$\underline{[P]}\ RSO_3Na \rightleftarrows \underline{[P]}\ RSO_3^- + Na^+ \qquad (2)$$

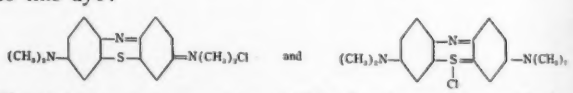
The complex $\underline{[P]}\ RSO_3^-$ has the properties of a complex ion having one or more valences (depending on the number of adsorbed RSO_3^- ions) and differs from a complex ion only in regard to size.

There is a stage in the adsorption of Metanil Yellow where it is impossible to remove all of the adsorbed dye from the wool or charcoal by washing with water. This stage may be pictured as the part of the RSO_3^- ions which are surrounded on nearly all sides by the chains of protein molecules of wool or atoms of activated carbon. Since these RSO_3^- ions cannot be removed by washing, and the washings have the same pH as the wash water, the sodium ions must remain in the wool or charcoal.

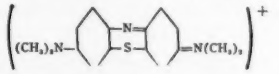
Now if sodium chloride, or a neutral sodium salt, is added to a solution of Metanil Yellow the excess of sodium ions in the solution will decrease the tendency of the sodium ions, of the Metanil Yellow, to diffuse away from the wool particle. Therefore reaction (2) is written reversibly. This allows the RSO_3^- ions adsorbed to become more firmly attached to the wool or charcoal by penetrating further into the spaces between the chains of protein molecules of wool, or, carbon atoms. This penetration leaves more room for more RSO_3^- ions to be adsorbed, although less firmly, at places nearer the surface of the wool or carbon particle.

Using an equivalent quantity of sodium sulfate instead of sodium chloride as the added salt with a common ion, a similar increase in the amount of dye adsorbed with the increasing concentrations of the salt added is noticed by inspection of Table V. This increase in adsorption may be explained in exactly the same manner as with sodium chloride. Sodium sulfate, however, does not have as great effect in increasing the adsorption of the dye as sodium chloride. Considering the classical theory of solutions, this might be explained from the fact that a solution of sodium chloride is more highly ionized than an equivalent solution of sodium sulfate at the concentrations of the salts used in the dye bath. Considered from the modern theory of solutions, it is recognized that the activity of sodium chloride is greater than the activity of sodium sulfate which means the effective Na^+ ion concentration will be greater in a solution of sodium chloride than in one of sodium sulfate of the same equivalence. So, in the consideration of both theories of solution, the amount of dye adsorbed is dependent on the relative number of common ions (according to the classical theory) or on the effective ion concentration of the salt with the common ion (according to the modern theory) present in the solution.

Salts of Organic Color Bases.—Methylene Blue, the dye chosen for this group, is a dye of the thiazine group. The following two different formulas have been assigned to this dye:



Hydrolysis measurements of this dye in aqueous solution certainly infers ionization of the dye salt into the



or R^+ cation and the Cl^- anion.

Table VI gives the experimental results obtained in the adsorption of Methylene Blue dyestuff on wool and on charcoal with the addition of sodium chloride to the dye bath. The common ion in this case is the Cl^- ion. Due to the hydrolysis of the dye and the resulting hydrochloric acid in the solution, any increase of the common Cl^- ion from the sodium chloride has little effect. However, some increase in the amount of dye adsorbed is noted. This increased adsorption of the dye with increased salt concentration may be explained as before. In this case the adsorbent will be charged positively due to the adsorp-

(Continued on page 577)

PROCEEDINGS OF THE
American Association of Textile Chemists and Colorists

OCTOBER 7, 1935

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Counter nominations for any office signed by at least ten members, if filed with the Secretary not later than November first, will be placed upon the ballot in accordance with the Constitution.

H. C. CHAPIN, *Secretary.*

Proceedings of the American Association of Textile Chemists and Colorists

Effect of Alkalies on Wool

By MILTON HARRIS*

ABSTRACT

Data on the effect of various alkaline reagents on the physical and chemical properties of wool yarn are presented. When wool is treated with dilute sodium-hydroxide solutions, a rapid splitting off of a portion of the sulfur occurs. On continued treatment, the sulfur content of the residual wool approaches a constant value of about 1.8 percent. The results indicate that the alkaline treatment has changed a portion of the sulfur to a form which tends to resist further splitting from the molecule. Oxidizing and reducing agents attack the disulfide groups and make wool more susceptible to alkaline treatments. The susceptibility of untreated wool to alkaline reagents appears to be closely associated with the lability of its sulfur in alkaline solutions.

I. INTRODUCTION

THE effect of alkalies on wool has been studied by many workers, generally from the standpoint of the effect of these reagents on the physical properties of the fiber. Wool fibers deteriorate rapidly in dilute solutions of sodium hydroxide. Buntrock[1], Washburn[2], Matthews[3], and Speakman[4] showed, however, that when the concentration is increased above 15 per cent, the strength of wool yarn begins to increase and reaches a maximum with a 38-per cent sodium-hydroxide solution, at which point the strength of the yarn is 30 per cent greater than the original strength. Speakman further demonstrated that the elastic property of a single fiber is unaffected after immersion in a 38-per cent caustic-soda solution, and that the increase in strength of the wool yarn is due to surface gelatinization, which causes fibers to bind together in the dried yarn. Chapin[5] studied the relative effects of sodium and potassium carbonates and soaps on wool and, for equal molecular concentrations, found them to be about the same.

Recent investigations by Goddard and Michaelis[6], Speakman[7], Pulewka[8], and Marriott[9] have shown that when wool and other keratins are treated with alkaline reducing agents, the disulfide linkages in the molecule are split and the physical structure of the fiber is destroyed. Goddard and Michaelis stated that the reducing agents acted on wool without bringing about any appreciable chemical alteration, other than that concerned with sulfur. Kuster and Koppel[10], however, found that as wool dissolved in sodium-sulfide solutions, a part of it undergoes disintegration with the formation of ammonia, and diffusible, nitrogenous, cleavage products.

The present investigation was undertaken to obtain quantitative data on the effect of alkalies on both the physical and chemical properties of wool. Such data are of importance in interpreting the susceptibility of wool to alkaline reagents.

II. MATERIALS AND METHODS

White worsted yarn prepared from raw wool which had been extracted with Stoddard solvent and washed with water, but which had received no previous chemical treatment, was used in this work. The yarn was further purified by extractions with alcohol and ether for 6 hours each and then washed with water at 125° F. All specimens were thoroughly conditioned and tested in a room maintained at a relative humidity of 65 per cent and a temperature of 70° F. The conditioned wool contained 14.3 per cent of nitrogen, 0.02 per cent of ammonia nitrogen, 3.16 per cent of sulfur, and 14.4 per cent of moisture.

The breaking-strength tests of the yarn were made by the single-strand method on a pendulum-type machine having smooth grips of the drum type, 1 inch in diameter. The distance between the centers of the drums was 10 inches. The values reported are the averages of 25 determinations.

The resiliency tests were made, employing a compressometer[11]. The compressional resilience of the specimen is the amount of work recovered from the specimen when the pressure is decreased from 2.0 to 0.1 pound per square inch, expressed as a percentage of the work done on the specimen when the pressure is increased from 0.1 to 2.0 pounds per square inch. The measurements were made on four layers of yarn, wound on metal frames made from thin brass plates, 2⅜ by 2⅜ by 1/50 inch, from the center of which a 2-inch square had been cut. Two

* Research Associate at the National Bureau of Standards for the American Association of Textile Chemists and Colorists. The work reported here was made possible by a grant from the Textile Foundation, Incorporated.

layers were put on the frames in each direction, each layer containing nine ends per inch.

The total nitrogen was determined by the Kjeldahl method, the ammonia nitrogen by distillation from magnesium oxide suspension, the total sulfur by the oxygen-bomb method[12] and the cystine sulfur by the Sullivan method[13]. An ammoniacal sodium-nitroprusside solution was used for the qualitative detection of the sulfydryl group.

The yellowing of the wool by the alkaline treatment was determined by measuring the reflectance of the specimen with respect to a magnesium-oxide standard at wave length 435.8 millimicrons with a Martens photometer, mercury-arc lamp, and suitable filter.

III. RESULTS AND DISCUSSION

1. Effect of Alkaline Reagents on Wool Yarn

Four-gram samples of wool yarn were treated with 200-ml. portions of sodium-carbonate and sodium-hydroxide solutions of various concentrations at a temperature of 125° F. for 30 minutes. The supernatant liquor was poured off, the wool washed for 4 hours in running distilled water, and then conditioned in an atmosphere of 65 per cent relative humidity and 70° F. The effects of the treatments on the physical and chemical properties of the wool are shown in Tables I and II. The results indicate that under the conditions of these experiments, there is no appreciable damage done to wool in sodium-carbonate solutions of concentrations lower than about 4 grams per liter (pH 11.1), and in sodium-hydroxide solutions lower than about 0.038 g. per liter (pH 11.8). Above these concentrations, the loss in weight of wool, nitrogen, and sulfur increases and the compressional resilience and the reflectance decrease with increasing alkali concentration. The breaking strength showed no significant changes.

The effect of various other alkaline reagents was determined by treating 4-gram samples of the wool yarn with 20-ml. portions of 0.25 per cent solutions of soap, borax, trisodium phosphate, sodium carbonate, and sodium metasilicate, all of which had been brought to pH 12.2 by the addition of sodium hydroxide. The temperature was 150° F. and the time of treatment 30 minutes. The skeins were washed for 4 hours in running distilled water and conditioned. The results are recorded in Table III. The data indicate that at pH 12.2, the solutions of sodium carbonate and trisodium phosphate cause the greatest chemical degradation of the wool. Duplicate experiments with these materials without the addition of sodium hydroxide were not made. The specimens treated with the soap solution were the whitest and most resilient, but showed the greatest decrease in breaking strength. The decrease in strength is attributed to the fact that the soap

TABLE I

Effect on Wool of Aqueous Sodium-carbonate Solutions at 125° F. for 30 Minutes

Concentration of Na_2CO_3	pH	Nitrogen in mother liquor	Sulfur content	Reflectance* Rx/R_{MgO}	Breaking strength	Compressional resilience
g/*liter*		mg/*wool*	*Per Cent*		kg	*Per Cent*
0	6.80	0.14	3.16	0.481	1.19	52
0.1	10.33	.20	3.17	.480	1.18	51
0.5	10.70	.17	3.16	.480	1.19	53
1.0	10.89	.15	3.15	.481	1.28	52
2.0	11.02	.18	3.17	.482	1.26	50
4.0	11.00	.40	3.12	.482	1.25	50
7.0	11.24	.61	3.11	.469	1.26	48
10.0	11.30	.65	3.03	.469	1.21	43

*The values represent the fraction of incident light reflected. The darker (or yellower as in this case) the specimens, the smaller the value for light reflected.

TABLE II

Effect on Wool of Aqueous Sodium-hydroxide Solutions at 125° F. for 30 Minutes

Concentration NaOH	Original pH	pH of mother liquor	Loss in weight of wool	Nitrogen in mother liquor	Sulfur content of wool after treatment	Reflectance Rx/R_{MgO}	Breaking strength	Compressional resilience
mg/*liter*			*Per Cent*	mg/g *wool*	*Per Cent*		kg	*Per Cent*
0.0	6.80	6.68	0.61	0.09	3.15	0.475	1.20	51
0.38	9.11	6.90	.60	.10	3.16	.471	1.19	52
3.8	10.83	8.77	.65	.08	3.17	.474	1.12	50
19.2	11.49	10.14	.69	.08	3.15	.476	1.20	52
38.3	11.82	11.33	.67	.11	3.03	.467	1.16	53
153.2	12.41	12.26	1.36	.84	2.93	.460	1.14	49
268.1	12.61	12.49	2.14	1.79	2.74	.463	1.19	48
383.0	12.73	12.66	2.55	2.50	2.55	.455	1.16	35

TABLE III

Effect on Wool of 0.25 Per Cent Solutions of Various Reagents Brought to pH 12.2 with NaOH
(Time of treatment was 30 minutes and the temperature 150° F.)

Reagent	Loss in weight: Wool	Loss in weight: Sulfur	Loss in weight: Nitrogen	Reflectance R_x/R_{MgO}	Breaking strength	Compressional resilience
	mg/g	mg/g	mg/g		kg	*Per Cent*
Sodium hydroxide	23.0	6.6	3.37	0.424	1.22	44
Soap	19.1	5.9	2.85	.477	.94	51
Borax	20.8	7.6	2.96	.429	1.14	44
Trisodium phosphate	24.8	8.4	3.83	.425	1.12	42
Sodium carbonate	26.0	8.2	3.66	.432	1.10	43
Sodium metasilicate	20.6	6.9	3.06	.442	1.13	44

TABLE IV

Effect on Wool of the Continued Action of 0.065 N Sodium-hydroxide Solution at 150° F.

Time of treatment	Loss in weight of wool	Total nitrogen in mother liquor	Ammonia nitrogen in mother liquor	Loss in sulfur content of wool		Sulfur content of wool after treatment	Moisture content of conditioned wool after treatment
Minutes	*Per Cent*	mg/g	mg/g	[b]mg/g	[c]mg/g	*Per Cent*	*Per Cent*
10	2.74	3.7	...	4.4	4.0	2.76	14.4
20	3.42	4.7	...	8.8	7.4	2.42	14.3
30	3.87	5.5	0.55	10.1	9.7	2.34	14.4
40	4.27	6.0	...	10.4	9.8	2.21	14.2
50	4.55	6.5	...	10.9	10.2	2.20	14.4
Hours							
1	4.83	7.5	.79	11.6	11.3	2.18	14.2
2	5.97	9.3	.98	12.8	12.1	1.97	14.4
3	8.38	12.6	1.26	14.0	13.6	1.90	14.5
4	9.11	14.6	1.37	14.5	14.0	1.86	14.3
5	11.20	17.7	1.79	14.9	14.8	1.85	14.4
24	[a]36.00	55.1	5.07	20.0	...	1.82	15.1
48	[a]66.00	92.8	8.02	25.5	...	1.87	16.6

[a] The residual wool after 24- and 48-hour treatment was gelatinous and a portion of the fiber was lost during washing. The accuracy of these values is questionable.

[b] Calculated from the sulfur content of the residual wool. The sulfur in the wool was determined by the oxygen-bomb method.

[c] Sulfur found in the mother liquor. It was determined by treating an aliquot with *N* hydrochloric-acid solution saturated with bromine. The solution was allowed to stand on a steam bath for ½ hour and the sulfur determined as barium sulfate. It has been shown that the sulfur in wool or cystine is not oxidized to sulfate under these conditions. This indicates that the sulfur found by this method is split off from the wool.

solution kept the wool yarn soft and fluffy, whereas in the yarn treated with other alkaline solutions, the fibers were matted and stuck together.

2. Nature of the Action of Alkalies on the Sulfur of Wool

Although wool contains about five times as much nitrogen as sulfur by weight, the data in Table III show that about twice as much sulfur as nitrogen was removed from the wool under the conditions of the experiments. This indicated that the susceptibility of wool to alkalies is closely related to the lability of its sulfur in alkaline solutions. It seemed pertinent, therefore, to study the effect of the continued action of alkali on wool, and to determine the rate of removal of sulfur and nitrogen from the wool molecule.

Six-gram samples of wool were treated with 300-ml. portions of 0.065 *N* sodium-hydroxide solutions at 150° F. for various lengths of time, washed for 4 hours in running distilled water and conditioned. The loss in weight, and the moisture and sulfur contents of the yarns were determined. Aliquots of the mother liquors were analyzed for total and ammonia nitrogen, and sulfur. The results are given in Table IV, and are shown graphically in Figure 1. The losses in total and ammonia nitrogen are approximately proportional to the loss in weight of wool. The loss of sulfur, however, took place at a more rapid rate until the sulfur content of the wool had dropped to about 1.8 per cent, after which the loss was also approximately proportional to the loss in weight of the wool. It is of interest to note that after 4 hours' treatment only 9 per cent of the wool had been lost, 41 per cent of the sulfur had been lost, and the sulfur content of the treated

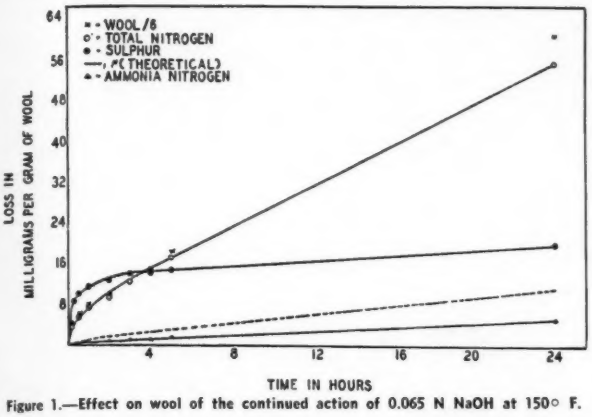


Figure 1.—Effect on wool of the continued action of 0.065 N NaOH at 150° F.

wool had dropped to 1.86 per cent. Similarly after 48 hours' treatment, 66 per cent of the wool was lost, but the sulfur content of the residual wool was still 1.87 per cent. The broken curve in Figure 1 represents the theoretical amount of sulfur that would be lost if the sulfur had split of as an integral part of the wool molecule.

When specimens of the wool yarn were treated with 0.25 *N* sodium-hydroxide solutions under the conditions described, the sulfur content of the residual wool became constant after about 20 minutes at about 1.8 per cent. The results are given in Table V.

TABLE V

Effect on Wool Yarn of 0.25 N Sodium-hydroxide Solution at 150° F.

Time of treatment	Loss in weight of wool*	Sulfur content of wool after treatment
Minutes	*Per Cent*	*Per Cent*
10	22	1.91
20	34	1.85
40	46	1.78
60	58	1.83
90	68	1.79

* Wool became gelatinous.

The experimental results seemed to indicate that this initial rapid splitting off of a portion of the sulfur from wool might be due to one of several factors; namely, that a large proportion of the sulfur of wool was concentrated near the surface of the fiber; that the sulfur was chemically combined in wool in more than one way; or that a portion of the sulfur was changed to a more stable form during the alkaline treatment.

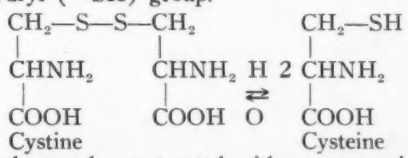
The distribution of the sulfur in wool was investigated by studying the effect of the alkali on powdered wool. Three-gram samples of wool which had been ground in a ball mill (particle size 0.3 to 2μ) were put in 150-ml. portions of 0.065 *N* sodium-hydroxide solutions at 150° F. for various lengths of time, after which the alkaline solutions were quickly cooled in ice water, centrifuged for 5 minutes at 2,200 r.p.m. and the supernatant liquid decanted. Distilled water was mixed with the residue and the resulting suspension again centrifuged. This rinsing was repeated six times. The powder was dried for 24 hours at 105 to 110° C. and the total sulfur determined. The results in Table VI show that the sulfur content decreased at a slightly faster rate than that of the wool yarn, but became constant after 3 hours at about 1.8 per cent (calculated on basis of 14.4 per cent of moisture). The close agreement of the results obtained on the wool yarn and wool powder indicates that the sulfur is uniformly distributed throughout the wool fiber.

TABLE VI

Effect on Powdered Wool of 0.065 N Sodium-hydroxide Solution at 150° F.

Time of treatment	Sulfur content of wool after treatment	Time of treatment	Sulfur content of wool after treatment
Hours	*Per Cent*	*Hours*	*Per Cent*
1	2.00	4	1.80
2	1.95	5	1.78
3	1.85	24	1.81

That the bulk of the sulfur in wool is not combined in more than one way and is practically entirely present as cystine sulfur, has been shown by Rimington[14] and by Sullivan and Hess[13]. Employing the Sullivan method for the determination of cystine, it was found that at least 96 per cent of the sulfur of the wool used in these experiments was cystine sulfur. The presence of practically all of the sulfur in one form was further demonstrated qualitatively by the following procedure. When cystine was treated with an ammoniacal solution of sodium nitroprusside no reaction occurred. On addition of potassium-cyanide solution, the cystine was reduced to cysteine according to the following reaction and a violet-red color was produced. The nitroprusside reaction is a test for the sulfydryl (—SH) group.



Similarly, wool was treated with an ammoniacal solution of sodium nitroprusside and gave a negative reaction, but after addition of the reducing agent, a violet-red color developed on standing. In view of these results, it appears that the alkaline treatment has changed a portion of the sulfur of wool to a form which tends to resist further splitting off from the molecule on continuation of the treatment.

3. Effect of Alkalies on Wool Treated with Oxidizing and Reducing Agents

It is well known that when wool and other keratins are

treated with alkaline reducing agents, the disulfide linkage (cystine sulfur) is split. Oxidizing agents also react with the disulfide groups in keratins, but their action is not specific for these groups, since they are known to attack other parts of the protein molecule. The oxidation of the disulfide group proceeds very slowly and it is only with difficulty that these linkages are split by oxidation methods.

It is obvious that a number of oxidation products of cysteine and cystine are possible. The intermediate oxidation products have never been definitely isolated although Lavine and Toennies[15], in studies of the oxidation of cystine in non-aqueous media, obtained a precipitate with a composition approximating that of a sulfoxide. There is, as will be shown later, some evidence which indicates the formation of these intermediate products during the oxidation of wool.

The effect of alkali on oxidized wool was studied. Wool yarn was treated with 3 per cent hydrogen-peroxide solution for 24 hours at room temperature, after which the yarn was thoroughly rinsed and conditioned. The sulfur content of the treated wool was slightly lower (3.12 per cent), but the physical properties were the same as those of the untreated wool. When the oxidized wool was treated with an alkaline nitroprusside solution, a negative test was obtained, but on addition of sodium-cyanide solution, a violet-red color was produced. The color obtained with the nitroprusside test developed much more rapidly with the oxidized wool than with the unoxidized wool. However, when equal amounts of the treated and untreated wool were dissolved in normal sodium-hydroxide solutions and equal amounts of sodium nitroprusside were added to each, the solution of the unoxidized wool was the more deeply colored. The results show that oxidation has made the disulfide group more labile to alkaline reagents, but has also reduced the number of potential sulfydryl groups in the oxidized wool. This suggests the possibility that under the conditions of the oxidation in these experiments, intermediate products such as the following are formed:

R—SO—S—R or R—SO_2—S—R

Samples of the oxidized wool were treated with 0.065 *N* sodium-hydroxide solution as previously described. The loss in weight of the wool and the sulfur content of the wool after treatment are given in Table VII. The sulfur content became constant after 2 hours at about 1.96 per cent. The rate of loss in weight of the wool was much greater than that of the unoxidized wool treated with 0.065 *N* sodium-hydroxide solutions.

When samples of the wool yarn were treated with 0.065 *N* sodium hydroxide solutions containing 1 per cent of sodium sulfide, and with 1 per cent sodium-sulfide solutions alone, the wool fibers deteriorated rapidly. All of the samples became gelatinous within a few minutes, which prevented an accurate determination of the loss in weight of the wool. It was estimated that for the shortest period of time (½ hour), the wool lost more than 50 per cent in weight. The sulfur contents of the residual wool are given in Table VIII. Addition of the reducing agent splits the disulfide linkage and the wool rapidly loses its fibrous structure.

TABLE VII

Effect of 0.065 N Sodium-hydroxide Solution at 150° F. on Wool Yarn Which Had Been Treated for 24 Hours with a 3 Per Cent Hydrogen-peroxide Solution

Time	Loss in weight of wool	Sulfur content of wool after treatment
Hours	*Per Cent*	*Per Cent*
½	7.8	2.41
1	9.9	2.30
2	12.1	2.02
3	14.3	1.97
5	18.9	1.95
24	48.8	1.96

TABLE VIII

Sulfur Contents of Wool Treated with 0.065 N Sodium-hydroxide Solution Containing 1 Per Cent of Sodium Sulfide and with a 1 Per Cent Sodium-sulfide Solution Alone at 150° F.

Time	Sulfur content of wool treated with 0.065 *N* NaOH + 1% of Na_2S	Sulfur content of wool treated with 1% of Na_2S
Hours	*Per Cent*	*Per Cent*
½	3.03	3.04
1	2.94	...
2	2.86	2.77

It is of interest to note that while the wool deteriorates very rapidly in the presence of alkaline-reducing agents, the sulfur content of the residual wool was much higher than when sodium hydroxide alone was used. This suggests that the disulfide sulfur is more labile to alkaline treatment than the sulfydryl sulfur. This is in agreement with the results of Gortner and Thor[16], who found that cysteine is more stable toward alkalies than cystine.

IV. CONCLUSIONS

When wool is treated with dilute sodium-hydroxide solutions, a rapid splitting off of a portion of the sulfur occurs. On continued treatment, the sulfur content of the residual wool approaches a constant value. The results indicate that the alkaline treatment has changed a portion of the sulfur of wool to a form which tends to resist further splitting from the molecule. Oxidizing and reducing agents attack the disulfide group and make wool more susceptible to alkaline treatment. The susceptibility

of wool to alkaline reagents appears to be closely associated with the lability of its sulfur in alkaline solution.

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Proceedings of the American Association of Textile Chemists and Colorists

UNEMPLOYMENT REGISTER

Members of this association, who are without employment, should forward to the secretary a statement as to their qualifications and experience. This information will subsequently appear on these pages with an identifying key number. Employers are also requested to file with the secretary any vacancies which may occur in their businesses.—H. C. Chapin, Secretary, Lowell Textile Institute, Lowell, Mass.

Key: A—Laboratory and research; B—Dyeing or printing; C—Finishing; D—Sales; E—Instruction; F—Executive.

Note: Persons who have obtained employment should notify the secretary at once. Prospective employers may file vacancies either with the secretary or the American Dyestuff Reporter.

A-3

Education—Ph.B., Brown University, 1920. Two years post-graduate work at M.I.T.

Experience—2 years instructor at M.I.T. 2 years as research chemist in print works (Gum thickenings, application of dyes, dye testing and evaluation. 4 years as chief chemist in bleaching, mercerizing, dyeing and finishing plant. 4½ years as research and plant chemist in silk mills (Colorimetric work in color matching, dye testing and identification and testing of chemicals). 2 years as organic research chemist (laboratory and semi-plant research on organic chemicals, intermediates and dyestuffs). Age 35, married. Will go anywhere, references.

A-6

Education—Analytical Chemistry and Dyeing Course, Lowell Textile Evening School.

Experience—Seven years as print color and dye chemist in printing, dyeing and finishing plants; recently in charge of textile printing department of dyestuff manufacturer.

A-B-2

Education—Lowell Evening Textile School, 1917.

Experience—Five years' experience in hosiery dyeing, full fashioned hosiery of silk and cotton and silk, also men's hosiery containing rayon, wool, cotton and celanese. Several years experience in laboratory work. Has also had experience in jig-dyeing of cotton piece goods, slub and top dyeing.

A-B-4

Education—B.T.C. 1934, Lowell Textile Institute.

Experience—Assistant chemist in cotton knitting plant; second-hand in woolen knit goods dye house. Will go anywhere; references.

A-B-5

Education—Graduate of the University of Lausanne, Switzerland. Doctor's degree in Chemistry. Knowledge of French and German.

Experience—Eleven years with large bleaching, dyeing, printing and finishing plant as assistant Chemist and then Chemist in charge of the Laboratory. Experience in dyeing and printing cotton and rayon fabrics; research and analytical work. Woman.

A-B-6

Education—B.S. in chemistry, Cooper Institute.

Experience—Seven and one-half years in application laboratories of large dyestuff manufacturer. One year as plant chemist in dyehouse and print shop. Seven years as chief printing colorist on silk, rayon and cotton. 33 years old; married; will go anywhere; references.

A-B-C-2

Education—Graduate of Lewis Institute of Engineering of Chicago and graduate of Philadelphia Textile School (Chemistry and Dyeing department).

Experience—Has had extensive experience as assistant chemist and colorist in silk printing, dyeing and finishing; also dyeing raw stock wool; and dyeing and finishing cotton and rayon. Age 30; married; references.

A-B-C-3

Education—3 years at Brown University and Drexel Institute.

Experience—2½ years in dyestuff laboratory; 3 years as second-hand, dyeing indanthrene and direct colors on rayon skeins; 6 months as boss dyer on silk and cotton ribbons and hosiery; 3 years overseer of dyeing and finishing rayon tubing. Can handle laboratory, dyehouse, finishing or outside service. Age 30; married.

A-B-C-4

Education—Graduate, University of Michigan, in Chemical Engineering, 1930.

Experience—One year as assistant chemist and research engineer with metallic packing concern. Three years' experience dyeing and finishing rayon tubing, last two years being foreman dyer. Familiar with other kinds of dyeing. Working knowledge of Spanish. Age 28. Married. References.

A-B-D-E-F-1

Education—Ph.D. in Chemistry, Pennsylvania, 1927. Graduate Work in Chemical Engineering, M.I.T., 1918.

Experience—5 years college teaching, 11 years industrial development and consulting work in diversified fields relating to textiles. Successful organizer and director of development and research. Married. Publications. Position must have opportunity for advancement.

A-C-1

Education—4 years at Newark Evening Technical School in Chemical Engineering.

Experience—8 years in manufacturing, research, testing of soaps, oils, gums and finishes and application of same in all phases of the textile industry. Age 23, single. References.

A-E-1

Education—Ph.D., Univ. of Illinois, studied chemical engineering at Columbia, licensed chemical engineer, New Jersey.

Experience—10 years' experience teaching in colleges, subjects included chemical and textile subjects. Has had broad experience in industrial work including experience in testing materials, research and consulting. Will go anywhere; references.

B-1

Education—Educated and trained in chemistry and calico printing in Glasgow, Scotland.

Experience—Has been with large print works as colorist for 13 years producing first class work on cotton, rayon, wool and silk fabrics. References.

B-2

Experience—Boss dyer with one firm for 18 years, divisional supt. at print works for 1 year, in charge of processing and dyeing of cottons and rayons at large bleachery for 6 years. Prefers bleachery in East but will go anywhere. References.

B-3

Experience—Foreman piece dyer for the past 21 years. Can dye the following: celanese, rayon, cotton backs, wool, silk and mixed fabrics. Has knowledge of finishing and laboratory work.

B-6

Education—Graduate R. I. School of Design.

Experience—5 years in bleachery, 7½ years as assistant dyer, 2 years as boss dyer and 3 years as superintendent of dyeing and finishing. Married, 33 years old. References.

B-7

Experience—Eight years as boss dyer on skeins and ribbons. Over ten years as chemist and head dyer for a large hosiery mill. Experienced on Silk, cotton, rayon and wool in skeins, ribbons, piece goods and all kinds of mixtures. Willing to go anywhere. Not afraid to work or face responsibility. Can handle help efficiently.

B-8

Education—Chemistry and Dyeing Department, Philadelphia Textile School.

Experience—Eleven years experience as chemist and boss dyer on the following: woolen, worsted and cotton yarn; woolen, worsted and union piece dyes on both ladies' and men's wear; wool, cotton, shoddy and mohair raw stock. Age 33, married, will go anywhere. References.

B-9

Experience—Hosiery dyer with fifteen years' experience on high grade silk hosiery; familiar with all types of machines. Age 43, married. Will go anywhere.

B-12

Education—2 years days at N. Y. U. and 3 years nights studying chemical engineering.

Experience—1½ years asst. colorist, 5½ years colorist. Experienced on vats, commercial and fast colors on cotton and cotton-rayon mixtures. References; age 29; married.

B-13

Experience—Large experience as an assistant colorist chemist in silk printing, dyeing and finishing; also on cotton and wool dyeing. References.

B-14

Education—Rhode Island School of Design.

Experience—Familiar with all classes of wool dyeing. Seven years with large carpet mill as dyer and processor of washed oriental rugs. Will go anywhere, married, 37 years old. References.

B-15

Education—B.T.C., Lowell Textile Institute, 1934.

Experience—Experience in dye house running washers, dye kettles and as a dye weighter.

B-17

Education—Lowell Textile Institute (Chemistry and Dyeing Course) 1916; extension courses at Brown University.

Experience—6 months dyeing wool at finishing company; 2½ years research work on bleaching, dyeing and finishing at dye works; inspector of textile equipment, U. S. Ordnance Dept., during war; 15 years as superintendent of dyeing at finishing company, including all types of colors on cotton piece goods and some rayon and celanese; handled chemical work at last named plant for many years as well as dyeing. Age 40, married, prefers East. References.

PROPOSED AMENDMENT TO THE CONSTITUTION

Article VII of the Constitution now reads, "Members whose dues are in arrears on March 1 of any year shall have notice sent them, and unless payment is made by May 1 they shall cease to have any right or privilege in the Association. Such members may, however, be restored by vote of the Council to the rights and privileges of the Association during the fiscal year in which they were suspended by full payment of the dues for that year, or during any future year by full payment of money due the Association at the time of the suspension plus payment of full dues for the year in which they seek reinstatement. Resignation shall be accepted at any time from members whose dues are fully paid."

The undersigned propose, in accordance with Article XII, that the Constitution be amended in Article VII, by substitution of January 1 for March 1, and by substitution of February 1 for May 1.

Wm. H. Cady	Samuel L. Hayes
H. C. Chapin	A. Kempton Haynes
R. F. Culver	H. F. Herrmann
Carl Z. Draves	E. C. Knaeble
T. J. Hall	H. Meyer
Jos. F. X. Harold	W. R. Moorhouse
George A. Moran	Samuel I. Parker
D. C. Newman	W. F. Robertson, Jr.
L. A. Olney	Robert E. Rose

A. R. Thompson, Jr.

Having been presented in writing to the Council, this proposal will be brought before the Annual Meeting on December 7, 1935.

Harold C. Chapin, *Secretary.*

CALENDAR OF COMING EVENTS

•

Meeting, New York Section, Chemists' Club, New York City, Friday evening, October 25th.

* * *

Annual Meeting, Chattanooga, Tenn., December 6th and 7th.

TECHNICAL PROGRAM FOR THE ANNUAL MEETING AT CHATTANOOGA DEC. 6-7

(Reprinted from last issue)

In accordance with the custom followed by other technical and scientific societies, the Program Committee of the American Association of Textile Chemists and Colorists invites any member of the Association with a worthwhile message in the field of textile chemistry to present a technical paper at the Annual Meeting in Chattanooga, December 6 and 7. This paper will then be published later in the Proceedings in the American Dyestuff Reporter.

Authors of papers are asked to submit titles as soon as possible to the Chairman of the Technical Program Committee. In order to encourage more intelligent discussion, abstracts of all papers will be published in advance of the meeting. These abstracts must be in the hands of the Program Committee before November 1. Final complete copies of the papers ready for publication in the Proceedings must be submitted at the time of presentation of the paper.

There has always been criticism from some sources that too few practical mill men take part in our Annual Meetings. Mill Men! Here is an opportunity for you to silence these critics by presenting papers which will steal the show from the laboratories of the dyestuff, chemical, and machinery manufacturers.

Carl Z. Draves,
Chairman, Committee for Technical Program,
273 Converse Street, Longmeadow, Mass.

The Read House

CHATTANOOGA, TENNESSEE

ANNUAL MEETING AND CONVENTION

CHATTANOOGA, TENN.

DECEMBER 6th & 7th

CONVENTION HEADQUARTERS

will be at the Read House pictured above. Out of two hundred rooms reserved for the Association one hundred and ten have already been taken. The travel bureau and ticket office at this hotel will handle all transportation arrangements and make reservations for members by rail, bus or air if desired. Convention facilities are said to be all that can be desired.

BELOW—HOTEL PATTEN

also to be used by members attending the annual meeting and convention. Two hundred rooms are being held for the convention weekend. All types of accommodations are available and rates and other information will be sent upon request.

COMMITTEES and CHAIRMEN

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American Association of Textile Chemists and Colorists

315

STANDARD SILK SAMPLES

There have been prepared, under the direction of the Sub-Committee on Fastness to Dyed Silk, standard dyed silk fabrics to represent four classes of fastness to washing—namely, Class I, Class II, Class III and Class IV. These standards have been carefully dyed with the dyestuffs and according to the dyeing methods recommended in the 1931 Year Book.

The A.A.T.C.C. is prepared to furnish sets of these washing standards for a nominal charge which will cover the cost of preparation. It will be possible to accurately grade the fastness by comparing it with the standards after subjection to the standard washing tests approved by this Association. All inquiries concerning these Silk Washing Standards may be addressed to the Chairman of the Research Committee—Louis A. Olney, Lowell Textile Institute, Lowell, Massachusetts.

AMERICAN
DYESTUFF
REPORTER

LOUIS A. OLNEY, Sc.D.
Professor of Chemistry and Dyeing, Lowell Textile Institute
Directing Editor

NORMAN A. JOHNSON
Managing Editor

MYRON DREW REESER
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THE ANNUAL MEETING

IT IS only eight weeks from this coming Friday when the members of the American Association of Textile Chemists and Colorists will gather at Chattanooga for their Annual Meeting and Convention. The arrangement committees chosen by the South Central Section, which is acting as host this year, have been at work for some time past making preparations for the coming event. The technical program committee headed by Carl Z. Draves has also been active and we wish to call your attention to the announcement of this committee which appeared in the Proceedings of the Association in the last two issues of the REPORTER and also appears on page 570 of this issue. Preparing a worth while technical program for the Annual Meeting is no small task and we wish to impress upon the members of the Association the importance of cooperating closely with this committee. A definite challenge to mill men is contained in that announcement and it is up to them to accept the challenge and carry it through.

We have always urged the members of the Association to attend the annual meetings and we continue to do so. Read the pages of the Proceedings to follow the activities of the committees who are all striving to make the coming meeting a success. There is considerable laborious detail connected with the staging of an event of this sort and those who are partaking in this labor are doing it for you who will attend the meeting and convention.

● TEXTILE SCHOOL CONFERENCE

The third semi-annual conference participated in by the deans of textile schools located in the South and New England, has been called for Tuesday, Wednesday and Thursday, October 22, 23 and 24, at Stockbridge, Mass.

This series of conferences is sponsored by the Textile Foundation as part of its program of cooperation with the textile schools. The broad objective is to develop curricula and methods which will better qualify graduates to meet the demands of everchanging conditions in the textile industries.

The deans who have already indicated their intention to be present are: O. V. Adams, Texas Technological College, Lubbock, Texas; J. H. Bagley, Texas Textile School, College Station, Texas; E. W. Camp, Alabama Polytechnic Institute, Auburn, Ala.; Charles H. Eames, Lowell Textile Institute, Lowell, Mass.; W. D. Fales, Rhode Island School of Design, Providence, R. I.; E. W. France, Philadelphia Textile School, Philadelphia, Penna.; J. H. Handford, New Bedford Textile School, New Bedford, Mass.; C. A. Jones, A. French Textile School, Georgia School of Technology, Atlanta, Georgia; Thomas Nelson, North Carolina State College, Raleigh, N. C.; Henry W. Nichols, Bradford-Durfee Textile School, Fall River, Mass., and H. H. Willis, Clemson Agricultural College, Clemson, S. C.

● R. I. CHAPTER, LOWELL ALUMNI

The initial meeting of the Rhode Island Chapter of the Lowell Textile Institute Alumni Association was held on Thursday evening, September 12th, at the Narragansett Hotel in Providence. An organization meeting had been held about two months earlier. Temporary officers were chosen as follows: chairman—Leo Gleklen, Hope Knitting Mills; secretary-treasurer—Leon E. Moody, U. S. Finishing Co.; correspondent—Gerald F. Quigley, Franklin Rayon Corp. Permanent officers will be elected in March. The objects of this association are stated to be to promote (1) the interests of L.T.I., (2) good fellowship and (3) the exchange of professional knowledge. The membership of the R. I. Chapter is not restricted to residents of that state and any alumnus may become a member by filing an application with the secretary. It is planned to hold meetings the first Thursday of each month at the Narragansett Hotel at 8 P.M.

● LARGE ENROLLMENT

For three successive years all attendance records at the Textile School of North Carolina State College, which opened its fall session on September 18th, have been broken. More than 300 students, whose homes range from Canada to Mexico, and from New York to the Middle West, have been enrolled.

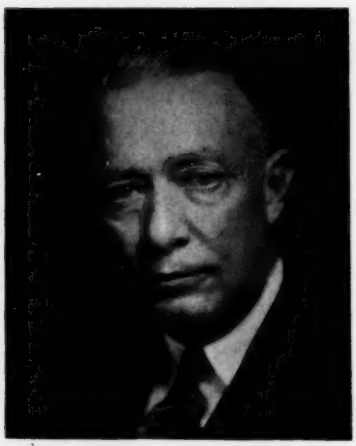
In addition to a large Freshman class, the enrollment has been increased by a number of students from other colleges who have transferred to North Carolina State in order to prepare themselves for service in the textile industry.

To give adequate instruction to the large number of students additions have been made to the efficient Textile School faculty, and during the year considerable new equipment will be added.

● S. O. M. A. MEETING

A combined business meeting and outing of the Sulfonated Oil Manufacturers' Association was held on Friday, September 20th, at the Manufacturers' Country Club near Philadelphia.

At the business meeting in the morning it was unanimously agreed to change the designation of staples over to the basis of active ingredients to take the place of the present and somewhat misleading method and a consolidation of "official" methods of analyzing sulfonated oils was approved. This latter will be printed and distributed shortly. A standard form of contract was approved in principle and unfair trade practices were discussed. Action upon these two subjects will be taken at the next meeting. A modest program of publicity, probably to start late in October, was approved.



C. P. GULICK
President, S. O. M. A.

Many guests were present for the golf tournament held in the afternoon and first prize, the Association cup with junior cup, was awarded to R. A. Scher of the Warwick Chemical Co. Other prizes were won by the following players: H. D. Armitage, E. S. Atkinson, H. T. N. Smith, D. S. Whiteman, J. C. Wolke, E. W. Goode, Ralph Roth, F. C. Scholler, C. D. Marlatt, Ernest Nathan, J. W. Corr, J. Smith, and C. M. Morrison.

The chairman of the operating committees of the Association are as follows:

Costing—A. J. Royce.
Laboratory—Ralph Wechsler.
Marketing—H. B. Hooper.
Publicity and Advertising—Clyde D. Marlatt.
Unfair Trade Practices—M. A. H. Braham.
Quality and Standards—Victor H. Berman.
Traffic—L. L. Grombacher.
Social—Fred C. Scholler.

● NEW SOLVAY OFFICE

The Solvay Sales Corp. has opened district offices in the Johnston Bldg., Charlotte, N. C., H. O. Pierce, who has been district manager with headquarters in Charlotte, is in charge of the new office.

● NACCONOLS

National Aniline & Chemical Co. has introduced two new products for the treatment of textiles—*Nacconol KP* and *Nacconol KPR*. They are sulfonated derivatives of synthetic compounds of fatty or oily character. They are chemically related to the soaps inasmuch as both are said to possess a similar form of aliphatic structure with which useful emulsifying, wetting and detergent characteristics are recognized as associated. It is pointed out, however, that whereas soaps are said to display a distinct alkaline reaction in solution the Nacconols display absolute neutrality. This is explained by the fact that soaps are of the character of soluble salts resulting from the combination of a strong alkali with a fatty acid but the Nacconols may be considered as the ultimate reaction products of a strong acid with a strong alkali. It is stated that the Nacconols do not hydrolyze like soaps but dissociate like sodium sulfate.

It is claimed that the Nacconols are perfectly stable in their resistance to acids and alkalies which property, it is stated, is of particular value where processing in acid media is required. It is further claimed that in the presence of hard water or acids they retain their detergent, wetting-out and foaming properties, together with excellent rinsibility and great resistance to oxidation. It is believed that they will prove of value as soap substitutes and assistants in textile processing and related industries.

The KP and KPR brands are chemically identical. The KP is light brown in color and is recommended by the manufacturers for those operations where the color of the product is of little importance. The KPR is the KP produced in a refined form and is light in color. It is recommended for processing materials of the highest quality. It is stated that it is of particular value in the processing of fibers of animal origin because of its non-staining properties. It is superior to the KP brand as a scouring agent for processing at higher temperatures.

A booklet has been issued describing the properties of the Nacconols and summarizes these properties by stating that these products constitute ideal scouring, washing, wetting-out and levelling agents since, it is stated, their properties are unaffected by dilute acids or alkalies, hard water or metallic soap solutions. The booklet further describes the use of the Nacconols in the processing of wool, cotton, silk, rayon and acetate silk. Copies of this booklet are available upon request.

● QUAKER REPRESENTATIVE

It is announced by the Quaker City Chemical Co. that Joe H. Zens of Milwaukee will represent them in the Chicago and Milwaukee districts. Mr. Zens is widely known throughout the textile industry and was a former president of the National Association of Hosiery Manufacturers. It is expected that his wide experience will prove of benefit both to his company and the manufacturers upon whom he will call. He will continue to reside in Milwaukee.

Washington News Letter

By WALDON FAWCETT

MEMBERS of Congress, irked by the remembrance of the annoyances of the protracted session of 1935, are already proclaiming confidently that there are no legislative responsibilities in sight to similarly stretch the 1936 session. Indeed, Administration leaders have encouraged the belief that the session which convenes in January, next, should adjourn not later than the end of April. Two consequences of a restricted Calendar seem assured. One, of which mention has already been made in these columns, is the improvement in the chances for the passage of various measures of special legislation that were side-tracked in the progress of a "must" program. A second sequel contemplates an increase of attention, both in committee rooms and the legislative chambers, to the annual appropriation Bills of the operation in 1937 of the Government Departments and independent bureaus. By the same sign there should be enlarged opportunity for representations to the Appropriations Committee and Subcommittees by groups or organizations interested in Federal research. Say, the associations in industry that seek the benefits which would come, indirectly, through increases in the appropriations for the National Bureau of Standards. In some instances technical groups, seeking to influence Congressional policies on appropriations have deemed it the better strategy to rely upon the voice in committee of a sympathetic Congressman rather than depend upon one of their own members as spokesman.

CENTRALIZATION OF STATISTICS

Late in the last session Congress enacted several measures that are not without significance for the REPORTER family. Notably, the statute known as the Central Statistical Act. This provides for the creation of a Central Statistical Board to plan and promote the improvement, development and coordination of, and the limitation of duplication in, statistical services carried on by or subject to the supervision of the Federal Government. And "so far as may be practicable" other statistical services in the United States. The Central Statistical Board will, in effect, take its orders from and report to a Central Statistical Committee consisting of the Secretaries of the Treasury, Agriculture, Commerce and Labor.

A new Official Gazette is authorized in a new law known as the Federal Register Act. Federal proclamations, orders, regulations, notices, and other documents (in the custody of the National Archives Establishment) will be promptly printed and distributed by the Public Printer in the new medium, to be known as the Federal Register. The new daily official gazette will publish all executive orders, etc., except those which have no general applicability and legal effect. That is to say this serial bulletin will give notice of every Governmental requirement, non-observance of which entails a penalty.

THE CHANCES OF DESIGN COPYRIGHT

Experienced, impartial observers of the legislative scene at Washington are inclined to discount the confident predictions which went forth, following the adjournment of Congress, that the next session will surely see the enactment of a measure to protect "artistic models and designs". Skepticism is not induced so much by the hazards which confront every Bill involving a controversial issue, as by special considerations in this particular case. One liability lies in the fact that the design measure, as approved by the Senate and sent to the House, excepts from the operation of the registration system products applied to or embodied in motor cars and accessories. This exemption has rendered fighting mad groups in certain other industries that, alike to the automotive industry, have long opposed all-inclusive design protective legislation. These dissenters will demand of the House of Representatives either defeat of the measure or a broadening of the exemptions.

A second factor which makes for uncertainty is the circumstance that the design protective project is attached, as an amendment, to a General Copyright Act. The Bill, in its larger aspects, is the subject of differences of opinion more serious, by far, than the cleavage in the design- and color-using industries. Conspicuously at variance are the views on copyright of the talking picture and radio-broadcasting industries, not to mention the attitude of the mechanical musical instrument industries. All in all, passage of a Copyright Act in the House is unlikely to proceed as smoothly as in the Senate.

"SECONDARY MEANING" IN TRADE AND TECHNICAL TERMS

With the support of the American Bar Association, a drive will be made upon Congress for legislation that would admit to the shelter of the Federal trade mark registration system, words or combinations of words which have acquired "secondary meaning" as distinguishing a particular product or line of goods. The impending movement is the more interesting in that it seeks to remedy a state of inequality and discrimination which has for years plagued the later comers in American industry.

The nation's basic trade mark law,—the Act of 1905, embodies a limited recognition of secondary meaning in what is known as the Ten Year Clause. The paragraph in question sets forth that any firm or individual who carried on exclusive use of a mark for the 10-year period from 1895 to 1905 might have the benefit of the presump-

tion that "secondary meaning" had been acquired and could register the time-tried mark, even though it be descriptive, geographical, or otherwise taboo. This rigid concession is, of course, out of reach of all firms that started in business since 1895, no matter what their achievements in investing dictionary words with special meanings. The law now to be sought of Congress would open the sanctions of monopoly to all marks which have acquired secondary meaning, regardless of the period when the secondary significance overlaid the primary meaning.

COLOR CONTROL RETARDS COPELAND BILL

There is more than meets the eye in the deadlock on the Copeland Bill for revision of the Federal Food and Drug Act. The impression has been encouraged that the Copeland Bill failed of enactment simply because, after passing the Senate, it arrived in the House of Representatives too late to allow consideration. That is to say, too late, if the House leadership elected to call for hearings in the House Committee on Interstate Commerce. Which preliminary was insisted upon, albeit the Senate Committee had conducted extended hearings.

Two retardents wrecked the chances, at the last session, of the Food and Drug Bill. One adverse influence was the circumstance that President Roosevelt was not insistent. The Copeland Bill never had full membership in the "must" program. The second, and even more serious, upset was due to the arousal of deepened opposition in industry,—an awakened resistance which found expression in the House side of the Capitol far more emphatically than in the Senate.

This opposition was inspired in considerable degree by resentment over the new propositions for color control. Various branches of the food industry have gradually aroused to vigorous resistance against any broad requirement for a statement of artificial color content on the label of every food product which contains a dye. The necessity of reprinting labels, wrappers, etc. is only part of the grievance. Manufacturers of candy and other products sold extensively to all classes of the population, are apprehensive that the color notation might create an erroneous impression on the part of persons who are not fully informed as to the harmless character of all Certified food colors.

Meanwhile, as though in a gesture of vindication, the U. S. Food and Drug Administration continues to give publicity to "seizures" of products on the charge that the presence of an artificial color conceals inferiority. Recent actions included procedure against lots of prepared artificial colors intended for use in salad oil mixtures and condemned because of misleading label references to olive oil. Department officials are proceeding on the theory that the offending artificial colors are responsible latterly for a rapidly expanding trade in mixtures of various domestic vegetable oils masquerading as imported oil. The color used is green, allegedly in imitation of certain types of olive oil and in conjunction with the color there is use of an artificial flavor which is asserted to impart a suggestion of olive oil to the finished product.

CODE-SPONSORING TRADE ASSOCIATIONS

In an effort to aid the organizations in trade which are endeavoring to take over the Code responsibilities originated under NRA, etc., the U. S. Bureau of Foreign and Domestic Commerce has compiled a directory of code-sponsoring trade associations. The listings include the Chemical Alliance,—re the Chemical Code and its three supplemental codes; the Chemical Engineering Equipment Institute, which has a supplement to the Machinery and Allied Products Code; the National Association of Dyers and Cleaners which liquidates a service code already partially suspended; National Textile Refinishers Association; Textile Bag Manufacturers; National Association of Textile Machinery Manufacturers; Master Engravers Guild, sponsoring the Textile Print Roller Engraving Code; and the National Textile Processors Guild. As a follow-up of this directory the Commerce Department plans to issue shortly a report containing textual information needed by trade associations in their new relationships. One objective in the development of the facilities for clearing information on the Code set-up and its continuance, is furtherance of the principle of standardization in formulation of ethical business practices. Incidentally, it may be mentioned that the intention is to facilitate the transfer to private intra-industrial or inter-industrial administration of Codes approved by the AAA or FACA, as well as the Codes nurtured by the NRA.

INCREASE IN COLOR DICTIONARIES

Following the example of Sears, Roebuck & Company, a number of the smaller mail order houses or specialty houses are incorporating in their catalogues "Color Dictionaries." The purpose, in all instances, is to translate to the consumer the meaning of the respective color-names enumerated,—whether these latter be new colors or standard, staple items. Upward of 200 colors are listed in a representative private color dictionary of this type and the approved policy in particularization is to define fanciful and arbitrary color names not only in ordinary descriptive terms but likewise via the medium of equivalents. As, for example, the citation of French Blue as synonymous with "China" and the interpretation of Pastoral as Apple Green. The disposition of advertisers who have fallen in with this trend is to establish intimate association between the Color Dictionary and the dyes employed in production. By way of illustration, there's the prefatory note to the Sears' Dictionary (in the Fall-Winter, 1935-36 Catalogue) reading "We're 'fussy' about dyes—insist that so far as possible all dyes used shall be, not just good dyes, but the best dyes known."

INSISTENCE UPON COLOR CONTRAST IN MARKINGS

All but unnoticed by laymen there has emerged a studied insistence upon color contrast in the marking of food and other commodities subject to Federal inspection. The latest evidence of this disposition to insist upon emphasis by use of opposites—in—color is found in the Order of

the Department of Agriculture which went into effect on October 1, 1935. Instructions have been issued to all meat inspectors and packers by Chief J. R. Mohler of the Bureau of Animal Industry that henceforth required Government markings must be printed plainly on colored, artificial casings for meat products before such casings are stuffed with sausage or other meat product. The Government holds that colored artificial casings cannot be successfully marked with branding fluid after filling. Lack of contrast is blamed for shortcomings in color visibility.

Salt Dyes—

(Continued from page 559)

tion of the R^+ cation. Increased Cl^- ions in the solution will keep the Cl^- ions on the adsorbent and so permit more R^+ ions to be adsorbed.

Of course, in the dye baths with added salts other ions are present besides those discussed above. In the Metanil Yellow dye bath with added sodium chloride or sodium sulfate the Cl^- and $SO_4^=$ ions compete with the RSO_3^- in the adsorption on the fiber. In the Methylene Blue dye bath with added sodium chloride the Na^+ ion competes with the R^+ ion of the dye in the adsorption. In all cases, the organic ion is adsorbed so much more than the inorganic ions that the latter have very little effect on the adsorption of the colored dye ion.

Thus, it has been definitely shown that dyeing with salts of organic color acids and bases, which form true solutions in water is an adsorptive process and that these salts are removed as such by the fiber, assisted by neutral salts containing a common ion.

SUMMARY

Salt dyes are salts of organic color acids or organic color bases which form true solutions in water, are removed as the salt by the fiber, and are dyed with the aid of neutral salts containing a common ion. Dyeing with salt dyes is an adsorption phenomenon. The effect of neutral salts with a common ion on the adsorption of organic color acids is analogous to the effect of neutral salts with a common ion on the adsorption of inorganic bases. The effect of neutral salts with a common ion on the adsorption of salts of organic color bases is analogous to the effect of neutral salts with a common ion on the adsorption of inorganic acids.

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Gum Arabic*

Origin, Gathering and Marketing

GUM ARABIC is the gummy exudation of Acacia Verek, one of the 400 or more known species of the Acacia family of which about twenty-five are to be found in the Sudan. It has been known and used since the most ancient times, being employed by the Egyptions in the making of paint colors 2000 years B.C. It has been an article of commerce since the first century A.D. and since it was shipped to Arabian ports and thence to Europe received the name of Gum Arabic.

The Acacias are the chief constituent of the thorn forest of the Arid Zone, a belt stretching across Africa from Abyssinia in the east to French Senegal in the west and chiefly between 12° and 13° Latitude. The best of the gum and the large majority of the crop comes from the province of Kordofan, although large quantities also come from Gedaref, Gezireh and Gallabat. This is not of such good quality however. Gum Senegal also is shipped from the French Senegal and is very similar.

The trees grow to a height of from 12 to 15 feet in the Sudan, have a light gray bark and small feathery foliage with dark hooked thorns. Being a leguminous tree it is used much by the Arabs in the reclamation of waste land worn out by excessive cultivation. It is often cut down by the natives to make thorn fences for coralling animals. It also affords fine grazing for camels who appreciate the tender shoots. It is not raised much from seed but propagated by natural regeneration. The life of the tree is about 25 years, after which it usually succumbs to the attack of various insects and is finally destroyed by white ants. Growing in the sandy wastes of this arid region it has to struggle for water and its long lateral roots are often as long as 20 feet.

The gum picking season starts after the rains are over and continues until the beginning of the next rainy season or approximately from October to May or June. The total rainfall governs in a great measure the size of the crop, after a season of heavy rain the crop will be small and vice versa. The time of starting tapping is governed to a great extent by the temperature following the rains, if it be hot the leaves will wilt and fall and the season will start.

The tapping is done as follows: The native will cut off with his axe the lower branches of the trees to give him access to them. Then he nicks the tree with his axe, taking care to cut just under the bark and not into the wood. He then lifts the edges of the nick and pulls one up and the other down the tree until they break off. If the weather is hot the gum starts exuding and in about three weeks to a month there will be sufficient gum to collect. If the weather be cold, a much longer time will elapse. The gum

*By the Gum Department, Jacques Wolf & Co.

does not exude all along the wound, but only in spots along it and forms the tears which are crystallized by the heat. When the native sees there is sufficient gum for collecting, he starts doing so and goes out at an interval of a week or so until the season ends. The women also help in the collection but do not do the tapping.

If the Arab owns a camel he takes it to market himself, otherwise he sells it to one who has, who takes it to market. Formerly, the sale of the gum in the market was a very crude proceeding, often times the buyer using his leg which he said weighed so much as the weight in one of the pans of his scales. Since 1922 however, the Government supervises the auctioning of the gum in all the markets. The method is as follows:

When the Arab arrives at the market he is given a ticket with the number of the lot in which he is to place his gum. A record is also made on a form of the number of the lot and the Arab's name. Every bag in each lot is then opened and the merchants examine all the day's offerings. At a certain time the gates of the market are closed and a Government clerk opens the auction starting with lot No. 1 and so on. When bidding has ceased the owner of the lot is asked if he will sell at that price. If so, the price is entered on his ticket and the form filled out. At the end of the auction the gum is transferred from the Arab's skins to the merchant's sacks and weighed by the Government clerk in the presence of both buyer and seller and the calculation made. The buyer then must pay the seller. The auction seldom takes more than an hour and everyone is satisfied whereas under the old system sales sometimes took all day.

After the weighing the merchant takes it to his own sheds, where it is cleaned, usually by pilgrims on their way to Mecca, and then put in double sacks and sent by Railway to Port Sudan and thence to the markets of the world.

It is interesting to note that gum is only obtained from the trees when they are in an unhealthy condition. A healthy tree growing in a spot near water or on well fertilized ground will remain in leaf almost all year. If tapped, the wound quickly heals and no infection occurs. The gum is supposed to be the result of a bacterial infection of the wound which only takes effect when the tree is unhealthy. The method by which the infection is introduced seems to be a matter of varied opinion among authorities, some holding it to be from flies and ants which seem to swarm over the new wound, others advancing other theories.

Gum Arabic has a number of well known uses, some of which are pharmaceutical, confectionery, textiles (both as a finishing agent and in printing), as an adhesive, making of syrups, purifying of liquors, sizing, lithography, and manufacture of matches. The total consumption amounts to 15,000 to 20,000 tons per year, of which the U. S. A. uses at least one-fourth.

Open Forum

(*See previous issues for details of this department*)

New Questions

29—Is there any known method for stripping sulfur black dyed cotton, or sulfur dyed cotton of other colors in the presence of wool without injuring the wool? The fabric particularly in mind is a sulfur dyed cotton warp with a worsted filling.—**P. B. M.**

30—Will you give me an opinion on the maximum safe temperature for drying of viscose and acetate rayon fibers and fabrics?—**R. C. B.**

Unanswered Questions

27—Is there any satisfactory method for detecting the presence of sulfur black on a dark blue dyed fabric when a small amount of sulfur black has been added to the sulfur blue to deepen the shade?—**P. B. M.**

28.—I am in need of some information in regard to the dyeing of cotton ducks with vat dyes.

The method I am using is the regular pigment pad method, reduction being carried out subsequently in jigs.

In padding 8 oz. and 10 oz. army ducks what density top and bottom padder rolls would be best adapted? Our pad rolls at present contemplated are bottom, 20 plastometer, top 70 plastometer. We have found that equal density rolls give a shading from face to face. The face next to bottom roll being much darker under this condition.

Should this fabric pass under an immersion roll in the pad box before entering the nip, or, will the method use on light weight goods, passing the cloth directly into the nip having the bottom padder roll partially immersed in the pad box and a spray pipe on the top surface to feed the dye liquor, be best adapted to this type of fabric?

Information in regard to the above will be highly appreciated.—**A. M. L.**

● GENERAL RELEASES

General Dyestuff Corp. announces release of the following product:

Algosol Yellow V—a homogenous dyestuff producing very bright shades of a greenish yellow. It is said to be suitable for padding and dyeing purposes according to the nitrite process. The shades thus obtained are said to be very fast to washing, excellent to chlorine and fairly good to light. This product may be used in combination with other Algosol dyestuffs.

Algosol Yellow V can be printed according to the method of printing this class of dyestuff. The shades thus obtained are said to be very fast to washing, excellent to chlorine and fairly fast to light. The dyestuff is said to be especially suitable for producing yellow shades of green in conjunction with Algosol Green I B W. It can also be printed in conjunction with Rapidogen Green G.

Separate circulars describe this product, according to its use: G D C—121 for printing and G D C—122 for dyeing.

Fifteen Years of

Hosiery Dyeing—III

By NOEL D. WHITE

(Concluded from last issue)

STOCKING UP WITH NEW SHADES

FIFTEEN years ago hosiery was mostly dyed in sombre colors, with black predominating. Black was a staple in any line, selling more than all the fashionable shades of those days put together. White came next in popularity and in the summer time sold even better than black. The few shades in vogue were just to fill in a scant need for fashionable people who bought a pair or two with a box of black or white hosiery. The reason for this state of affairs was that stockings were bought for service, were strong, were supposed to last more than a season and were worn with any color fashion decreed for garments for ladies' wear.

In this mill we had by this time three good colors, Cordovan, Navy and Grey, besides black and white and were thinking to enlarge the range by two more, a lighter brown and a darger grey. The Standard Color Card did not yet specialize on leather and hosiery colors as at present and it was useless to try and select from the card shades applicable to hosiery. We had to use our imagination in devising shades and copy more or less from shades issued by some other enterprising hosiery mill. I used to investigate the hosiery display in the department stores searching for popular hosiery shades, making samples and submitting them for approval. Since the fashionable shades were so few it was a problem to stock up with the ever present danger of the chance to hold the stock unsold. The mill had made it a rule to take back from the customer all shades that did not move fast enough and replace them with shades which sold readily. It was costly to the mill to put out colors that proved unpopular and have to redye the hosiery black later.

Many times a piece of leather or a shoe was brought in the dyehouse to match for a new shade in which case it was a trying ordeal, before a match was obtained, that would please both the manager and the superintendent.

INTRODUCING FANCY DYEING

During the summer of my first year in this place the superintendent had some yarn made of silk and cotton twisted together and used it to knit some half hose for himself and the rest of the management personnel. When he gave them to me to dye black I asked him would he like to have some fancy work done on that hosiery? He said it would be fine to see what could be done with mixed yarn, but to do it only on a few pairs and we decided to dye half a dozen pairs blue and red.

Having boiled-off the whole lot of those stockings we kept the six pairs out and dyed the rest black. In a bath of olive soap and Glauber's salt we dyed the six pairs with our direct dark blue which went on the cotton leaving the silk quite clean. Then the stockings were washed until clean water could be squeezed out of them and the silk was dyed in an acid bath with fast red. The result was a changeable shade that looked variable, red, purple or blue, according to from which point the light fell on the stockings. This effect was hardly suitable for hosiery at that time, but it gave them an idea which, when tried, turned out a success that paid quite well during a slack season later.

Silk hosiery were not yet worn extensively. In the winter time especially warmer wool and cotton hosiery were still preferred by most women. In order to increase the demand for our hosiery during the cold season the management decided to put in a line of hosiery knitted with a thread of cotton and silk twisted together like the thread used in those half hose, and have me dye them in some conservative color that would appeal to the fair wearers.

Accordingly, several combinations of two-color effects were produced out of which three were selected and submitted to our customers for approval. One was a black and silver combination, the other yellow tan and dark brown and the third a navy blue peppered with gold. All three found a ready sale and we were kept busy from fall to late spring, working early and late to fill the demand for those three combinations of two-tone hosiery.

This is the way we did it. The goods were first boiled off in the regular way using only 10 per cent of olive oil soap with 1 per cent of soda ash. Without rinsing, we dyed the cotton first the color wanted, black, blue or brown and then washed the lot clean to cross-dye the silk the shade needed. There were two things that had to be watched to insure success. First, the alkalinity of the bath while dyeing the cotton, to keep the dye off from the silk, and second, the goods had to be washed thoroughly after dyeing the cotton, to prevent any unexhausted cotton dye from being carried in the bath for dyeing the silk. These were all the secrets connected with the work, but we surely thought we had something great, until we found out that others had done the same things before us and were still doing them just as successfully.

The formulae we used will be worth while inspecting:

Silver and Black

Developed Black 5%
Soap 2%
Soda Ash ..... ½%
Boil 20 minutes. Add
Glauber Salt 30%
Boil 10 minutes.
Run 20 minutes in cooling bath.
Wash thoroughly in running water.
Diazotize cold with:
Nitrite of soda 3%
Sulfuric acid 5%
30 minutes, wash.
Develop cold with:
Meta-phenylene-diamine ..... ¾%
Boiled with Soda Ash..... ¾%
30 minutes, wash, soap and finish.

Blue and Gold

Direct Dark Blue..... 2%
Diazine Black 2%
Metanine Yellow 1%
Soap 2%
Soda Ash ..... ½%
Boil 20 minutes. Add
Glauber Salt 30%
Boil 10 minutes.
Run 20 minutes in cooling bath.
Wash in running water until it flows clear.
Cross-dye silk in acid bath with:
Silk Orange ..... ¼%
Acetic Acid 1%
100 degrees F.
Add more Silk Orange if needed and finish without rinsing.

Two-tone Brown

S. & C. Cordovan..... 4%
Soap 2%
Soda Ash 1%
Boil 20 minutes. Add
Glauber Salt 30%
Boil 10 minutes.
Run 20 minutes in cooling bath.
Wash and finish.

THE USE OF DEVELOPERS

The first batch to cause us any trouble was a lot of silver and black. The silver had turned out too golden. More like a light tan and defied all our efforts to reduce it. We finally made it a presentable gray by shading it with Acid Green and Methyl Violet. The trouble was traced to a new shipment of developer.

In my last position I had many opportunities to work with all the developers and was quite familiar with the changes that could be obtained by mixing them with one another. A strong developer can not be altered by a weaker one. In order to effect a visible change in the developing power of 12 ounces of metaphenylene-diamine it would take at least three times the amount of beta-naphtol or the effort is lost. On the other hand, to 12 ounces of beta-naphtol, 4 ozs. of the diamine developer would alter the shade quite considerably.

COMMON SENSE IN DYEING

With the spring season our two-tone hosiery took a decided slump in the sales. When we were about to discontinue them altogether our regular dyestuff salesman came around one day and after passing a few banalities asked me if we had much trouble in dyeing the two-tone brown. I told him it was the easiest to dye of the three. In fact, it had been so easy that his question seemed absurd to me. He wanted to know how we did it and would I mind showing him our formula. His best customer had never been able to dye it satisfactorily and he would greatly appreciate my help. He said that his main laboratory had worked out the formula for this customer, but never got it quite right.

As it was the end of the season for us on those colors there could be no objection in doing it, so I told him that a month earlier I would have refused to give him my formula because I would have considered it a disloyalty to my employer to divulge our working methods. Since it did not matter any more he was welcome to my formula and I handed it to him.

When he read that formula his face was a study, he was so surprised. He could not believe his eyes. The Cordovan was the first mixture of dyestuffs he had sold to this mill and that was what we used. No additions, no subtractions of dyes had been necessary. He wanted to know how we had managed to use it for dyeing both a solid color on silk and cotton hosiery and for two-tone on our fancy dyed hosiery, so I had to tell him.

While dyeing the first batch of Cordovan I had taken out a stocking before adding any acid to the dyebath and had noticed that the silk was only slightly colored. To exhaust the bath and dye the silk to match the cotton I had added acetic acid and got a good match. In dyeing the two-tone effect all I had to do was to omit the acid. To keep the silk still lighter the thing to do was to dye in an alkaline bath. The higher the alkalinity the lighter the silk would come out. One per cent of soda ash did it just right. It was nothing but common sense and an understanding of dyestuffs and chemicals. The little silk dyes that were in the Cordovan mixture did not warrant making up a new mixture, so we just ignored them and kept those dyes off the silk quite effectively, "don't you think?"

THE END OF SIMPLICITY IN FINISHING

With the warmer weather coming along that kind of mixed yarn was discarded. It became very apparent it had become too coarse a yarn for ladies' hosiery. The demand for sheerer hosiery was now prevailing and the size of knitting silk had to be reduced. In place of the 10 and 12 thread silk 4 and 5 thread hosiery were considered heavy enough and the first chiffon hosiery of three strand silk made on circular knitting machines were attempted, which found immediate sales among the ultra-fashionable.

With the advent of chiffon hosiery we had to find a better way of finishing them than we were doing. Our concern so far had been to give the hosiery the best natural finish possible. We did that so effectively that our hosiery was getting national recognition. Other mills were trying to imitate it.

One day our dyestuff salesman paid us a friendly visit and before he left he asked me would I mind telling him what we used in our finishing bath? I had to tell him that it was a trade secret that I did not care to divulge. Besides I said that I did not see that it would do him any good since he was not selling any finishes, but only dyestuffs. In reality I did not have anything to tell. We simply brought out the natural beauty and feel of the silk by degumming it properly and dyeing it right. I could not tell him that we did not use anything but a little sulfonated oil to make the hosiery pull easier on the board. It was so simple he might not have believed it, anyway.

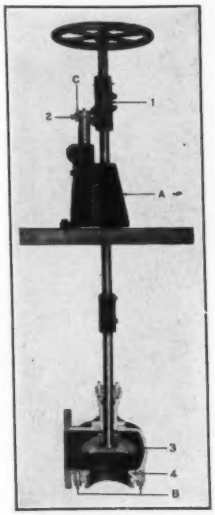
With the chiffon hosiery we had to provide something to make the hosiery lie flat and firm, when pulled off hot and dry from the boards. The flimsier fabric on cooling down would curl up at the edges and look anything but first class work. Being so thin this hosiery dried much quicker than the heavier kind and accumulated a lot of static. When coming off the boards full of heat it would balloon like sausages and were hard to pile orderly on the tables. In flattening them down they got full of wrinkles and distortions. To overcome that at first we tried leaving more moisture on the hosiery by reducing the time in the extractor, then we put in some dissolved glue along with the sulfonated oil in the last, finishing water. With this last addition, results were so gratifying that from that time carpenter glue became one of the most important items in our dyehouse.

Since it improved our chiffon hosiery we thought glue would surely help to improve the finish on the heavier goods as well, which it did, when used in moderation. When glue was expected to perform miracles to eliminate knitting defects, to tighten up and increase the firmness of loosely knitted hosiery, to straighten out kinks, distorted and crapy streaks, and when its use became an abuse it started giving trouble. When used in too large proportions glue was no longer useful and had to be cast aside in favor of some more versatile, masterly prepared finishing pastes. Something that would serve as a weighter and a filler, would penetrate and work evenly and leave the goods pliable and soft even when used in large quantity.

In order to keep up with the trend of fashion the finishing bath began to develop complications and today finishing hosiery properly takes about as long as the dyeing of it. It has become an operation of such importance that it has to be done with the greatest care.

● FRANKLIN DEVELOPMENTS

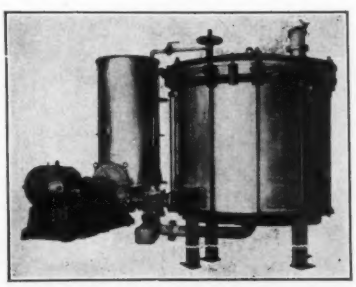
The Franklin Process Co. announces new development as follows. Further details concerning them may be obtained from the company.



Quick-Opening Valve (patents applied for)

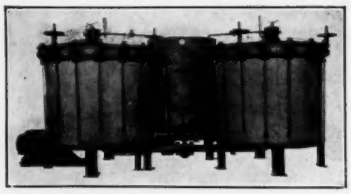
Quick Opening Drain Valve—for Franklin Process package dyeing, raw stock dyeing and silk soaking machines. Five major features of this valve are noted: (1) quick acting cam, (2) adjustable cam roll, (3) floating disc, (4) removable seat and complete quick drainage. The cam roll can be adjusted up or down in a slot by loosening lock nut C. The removable seat is held in place by screw studs B. It may be obtained in cast iron, stainless steel, aluminum, Monel metal or any other metal specified.

Fabricated Stainless Metal Package Dyeing Machine—with greatly simplified piping arrangement. The metal can be aluminum, stainless steel or Monel. The fabricated construction takes the place of the cast construction in some of the older models. In addition to making possible better matches and cleaner dyeings, it is claimed that this type of machine requires less floor space and a shallower pit. The simplified piping is said to facilitate setting up, reduce maintenance and make possible freer circulation. A removal bottom feature has been added which is optional.

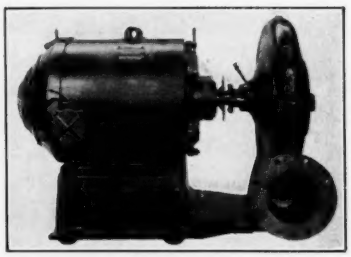

Fabricated Stainless Metal Package Dyeing Machine

Fabricated Stainless Metal Raw Stock Dyeing Machine—The advantages claimed for this machine are the same as for the package machine. This new model retains the removable bottom as in the older models and the dye liquor is forced through the stock from the top, one way only, thus not disturbing the stock, reducing waste to a minimum and improving workability.

Direct Connected Motor Driven Pump—for Franklin Process package dyeing, raw stock dveing and silk soaking machines. In this new design the motor shaft and



Fabricated, Stainless Metal Raw Stock Dyeing Machine.

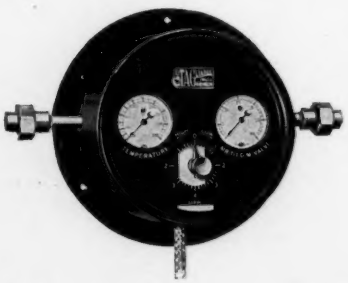


Direct Connected Motor Driven Pump

pump shaft are identical, the shaft being as short as possible, thereby making an important saving in floor space. The motor is of standard construction. Other advantages claimed include a saving in power and upkeep and improved circulation. The pump is of special Franklin Process construction.

● "TAG" CONTROLLER

C. J. Tagliabue Mfg. Co. has placed on the market a new instrument, said to be suited to the majority of automatic control applications, which will be known as the Tag Number 40 Controller.



The principle of control is basically the Tag movement which has been redesigned for compactness in such a fashion that the few simple parts are said to be easily accessible. A novel spring lever designed to eliminate all lost motion is said to multiply the movement of the powerful capsular spring for sensitive yet positive control. It is stated that the smallest change in temperature is transmitted positively and with precision to the ball air valve which in turn resets the rate of flow through the diaphragm actuated control valve. A bulletin is available which describes this instrument in detail.

● WOOL OIL

A new wool oil has just recently been placed on the market by the Laurel Soap Mfg. Co., Inc. This preparation, with the trade name of Laurel Wool Oil WR, prepared for lubricating wool fibers, is light in color and is said to have high emulsifying properties. It also is easily removed, it is stated, in the regular scouring bath.

● FATTY ALCOHOLS

Laurel Soap Manufacturing Company, Inc. has just announced to the trade its new fatty alcohols.

Recommended by that company for scouring and penetrating all fibers, these new products, known as Laurel Supersulfonates, come in powder and gel form and are said to be lime-resistant and to have high stability to acids and alkalies.

● BRITISH DYESTUFFS

Moderate improvement in the British dyeing industry during the second quarter of 1935 resulted in an expansion of dyestuffs consumption, according to a report from Bradford. The tendency to replace imported colors with those of British manufacture continues, the report states.

● WORLD CHEMICAL DEVELOPMENTS

According to C. C. Concannon, Chief, Chemical Division, Department of Commerce, reprints of Trade Information Bulletin No. 823 "World Chemical Developments in 1934" are now ready for distribution.

CLASSIFIED

The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i.e., help wanted, machinery or supplies for sale—the rate is $5.00 per column inch or less per insertion.

POSITION WANTED—by North Carolina Textile graduate. Thirty-four years old. Married, Protestant. Experience—8 years assistant to overseer, large Southern Mill using all types of dyestuffs, directs, sulfurs, vats, naphthols, basic and developed on package and raw stock. 2 years laboratory experience. Would like position with opportunity for advancement. References furnished on request. Address Dyer, care American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

WANTED—By an old established firm a technical sales service man for promotion of dye assistants. Practical experience desired in application and sales work in cotton, wool, silk and rayon. Apply Box No. 868, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.